The SIGHT SAVER

Bland

Marie Johnston
1068 24th Portland

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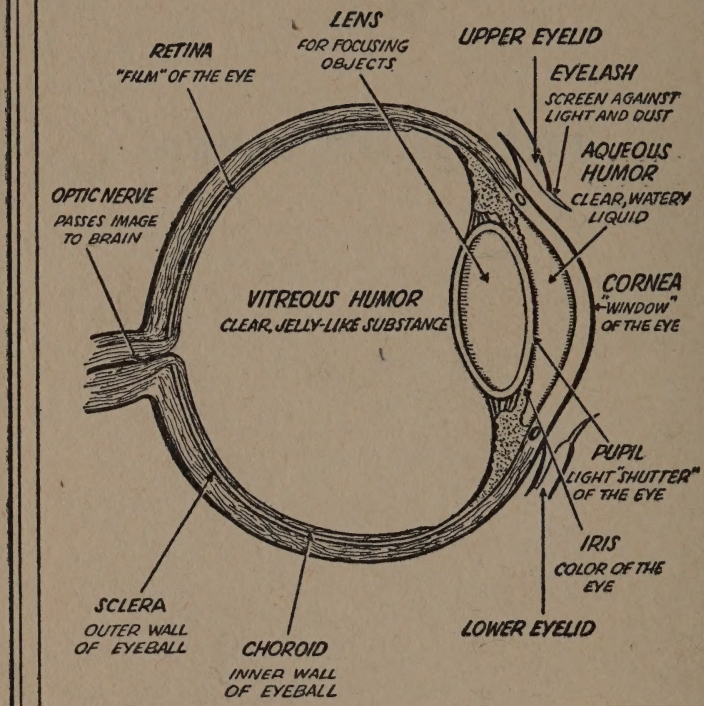

MECHANISM OF THE EYE

THE SIGHT SAVER

By

C. J. GERLING

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FOREWORD

I consider it a genuine honor to introduce a new book by an author whose past writings have won such high acclaim in medical and scientific publications. Gerling's approach to the subject of sight conservation is multi-dimensional, for he seems equally at home in many sciences—the natural and applied as well as the social sciences. He covers and cross-covers the science of optics and its techniques in glasses and lenses, the field of general ophthalmology, the evils of eye nostrums and quackery, the social problems of conservation, etc. And he organizes this varied data into an overall pattern as simple as his explanatory articles.

The science of optics is intimately interwoven with the study of the eye, for it is as much concerned with vision as with light. The author explains the basic principles of illumination—amount, kind, and arrangement—and the importance of glare in everyday life. Other articles, both general and specific, deal with the chief phases of lighting. Similarly, explanations are given on the subject of sight and the various types of vision. These articles include everything from normal sight to common visual disorders and refractive defects.

It is obvious that, if a work of this kind is to be primarily practical, the role awarded to glasses must be a considerable one. Special attention therefore has been given to this phase. Virtually all the different aspects of the subject will be found here, from the History of Glasses to an esthetic account of Appearance and Glasses. The diversity of discussion may be gathered from the titles of a few of the articles definitely devoted to the matter: Glasses, Sunglasses, Buying Glasses, Care of Glasses, Lenses, Contact Lenses, Goggles, etc.

The field of general ophthalmology also forms a substantial portion of this work, and each of its fundamental divisions—the structure, functions, and diseases of the eye—is given simplified arrangement in keeping with its non-medical purpose. The general article on the Eye is supplemented by particular items on the Cornea, Retina, Lens, Iris, Nerves, Conjunctiva, Eyelids, etc. Similarly, the general articles on Accommodation

and Diseases of the Eye are each supplemented by numerous specific items on functions and disorders. Particularly in these articles and generally throughout the book, the lay reader is constantly counseled to seek medical attention and cautioned against the dangers of delay.

Patent medicines all too often prevent medical care and lead to disastrous consequences. Recognizing these evils in the extensive use of patent eye products, the author describes individually the most common eyewashes, eye lotions, etc., and points out their dangers. The information in this book on widely advertised eye products, and on the quackery and frauds connected with sight, will prove an "eye opener" to many a reader. The layman who reads this book is not likely to continue buying these nostrums for self-treatment, but is sure to visit his physician or oculist instead.

If the curative aspects of sight conservation are two-fold—the suppression of quackery and fraud, and the extension of medical care—the preventive aspects are equally two-fold—social protection and the individual attitude. This whole subject is handled in various articles, and it is a salutary sign that here for the first time is a general book on sight saving which discusses both the curative and preventive phases. Moreover, this book gives practical help to the reader by suggesting the inexpensive pamphlets issued by the American Medical Association, etc.

The organization of the data in this book is as simple as its coverage is complex. Its alphabetical sequence and cross-reference system follow the general principles of the dictionary and encyclopedia. This arrangement furnishes the layman, and the physician as well, with the speediest means of referring to any special subject. It has also made possible the inclusion of a vast amount of information within a small compass. The contents are explained in simple, non-technical language and described with scientific accuracy. Thus, every one who wants to learn anything about the eyes and vision is herewith provided with an excellent and practical guide.

WINFIELD SCOTT PUGH, B.S., M.D.
Commander, Medical Corps, U. S. Navy, retired;
Consultant, U. S. Government Hospitals;
Department of Hospitals, New York; etc.

INTRODUCTION

It seems idle to tell people how valuable their eyes are, for that appears to be quite self-evident. Yet to judge by the neglect with which this irreplaceable blessing is universally treated, one would be inclined to say that few are aware of this indisputable truth. Perhaps its very obviousness is partly to blame for this indifference. Our eyes have been with us ever since we can remember and, even when defective, are ever-ready to give us marvelous service at any moment of the day or night, year after year subject to almost constant abuse and getting little or nothing in the way of repair or upkeep—an accomplishment not to be matched by any mechanical device. Combined with this, the eyes give us an accuracy and sensitivity of performance not to be found in the most delicate of precision instruments. All this seems so commonplace that we have come to take it for granted, with the result that we treat our eyes with a lack of consideration we would not dream of according to a steam shovel. It is small wonder that the eyes finally show rebellion in the form of the numerous visual and physical defects detailed in the present volume.

The handicap of poor vision is reflected in almost every phase of life we can think of—occupational, educational, cultural, recreational, etc. It is estimated that 85% of all we know comes to us through the eyes; and the indications are that civilized living will make increasing demands on vision, particularly as concerns livelihood. These demands may already be noted in the alarming growth of defective eyesight among the general population and in particular among school children. It is truly an uneasy situation to contemplate: the world so developing as to have ever greater need of the eyes, and the vision of the general public growing steadily worse!

A large portion of deficient vision need never have existed had a few simple cares been faithfully given the eyes from babyhood on. Even when sight defects have already been established, prompt recourse to corrective and protective measures will in almost every case prevent vision from becoming much worse, while suitable glasses will restore practically

normal vision in almost all instances. Moreover, most of the dread eye diseases, once commonly thought to lead to blindness, may now be successfully treated and halted, and often cured, *if only treatment is begun early enough.* As matters stand today, good, serviceable eyesight is generally a matter of taking advantage of the many means available for the protection and correction of vision.

This book is intended to aid one in that endeavor. Since the average person knows little of what may go wrong with eyes, the common defects, diseases, disorders, accidents, etc., that may afflict the eyes are herein described simply and as amply as the occasion demands, along with the usual measures available to combat them. But be it strictly understood, this is merely to acquaint one with what may be done for ailing eyes and is *not* in any sense to be considered as information for the self-treatment of the eyes. The very delicacy of the eyes that makes them need attention also demands that this attention be given only by trained and experienced hands, those of a graduate physician or oculist. Further, this volume attempts to detail the numerous but simple little precautions that should daily be exercised in the interest of the preservation of the eyes and sight. Finally, because no human mechanism may be intelligently cared for unless there is some clear understanding of how it operates, there will here be found such description and explanation of the eye, its structure and its function, as to at least partly achieve this purpose. The descriptions of the eye and its working that appear in this book, while scientifically correct so far as they go, are not to be considered as complete and definitive to the last detail; that alone would require a work much larger than this. The effort has been to make them only sufficiently full for the purpose—general information for the average person—without getting into technical complexity. In passing, I beg leave to point with pride to one feature in this connection, namely, that I have resisted the all too common practice of describing the eyeball and its mechanism in terms of a camera, without ever taking the trouble to explain how a camera works! After all, the average person knows no more of what goes on inside a camera than he knows of an eye.

Much labor has been expended in this volume on arrange-

ment. Instead of following the customary form of large and rather vague chapter divisions, I have cut up the subject matter into small unit items, each treating one single phase of the subject separately and concisely. I have placed each item under the most obvious heading possible, and have arranged them alphabetically so that each may be turned to at will as occasion or interest prompts, thus making every feature of the entire subject as accessible as a word in the dictionary. Where one may desire further information than is present in a given item, he may by following the cross-references there given (and the references under those, and so on) pursue the matter as far as his interest or need dictates. This book, then, is intended for general easy reference by the average person on matters pertaining to the eye, sight, and their care. If one knows little about the whole matter, it may be read through and thereafter referred to at need. Or one may start with one of the general items in the field of his particular interest (*eye, sight, defective sight, care of the eyes, glasses, care of glasses,* etc.) and follow the references given there.

It has been my good fortune to have the guidance and services of Esar Levine in the preparation of this work. I am indebted to him not only for his expert assistance but for his wise counsel as well. Whatever value this work possesses is due in considerable measure to his extraordinary and extensive research.

C. J. GERLING.

ACCIDENTS TO THE EYE. See *Injuries to the eye.*

ACCOMMODATION. This is the process by which the eyes operate, or strive to operate, to see clearly and adequately at all times regardless of variations in illumination of the object seen or in its distance from the eyes. Thus, the two main factors in accommodation are the adjustment of the eyes to light and to distance in each individual circumstance. This circumstance may change very much a great number of times within a few moments as the vision shifts about in the course of normal, active seeing.

The accommodation or adjustment to variations in light is accomplished by two organs within the eye: the iris and the retina (which see). By contracting, the iris admits less light to the retina; by expanding, more. But this alone would not supply sufficient compensation for the great changes that may take place in illumination (from a small part of a foot-candle in starlight, to perhaps 10,000 foot-candles in bright sunlight) since the change from the smallest to the largest openings of the iris is only about 20 times. The remainder of the accommodation to light is done by the retina of the eye. Here by alteration in the lengths of the rods and cones making it up and by changes in its chemical constitution, the normal eye so adapts itself as to be properly sensitive to whatever light is present in order to achieve the clearest vision possible. These changes, of course, require a little time to occur, which explains why one is blinded for a moment on coming from the dark into a bright light, or sees poorly for a while on going from a well lighted room into the dark.

Accommodation to variations in the distance to the object observed is achieved by alteration of the focus (which see) of the eye. This is done by changes in the curvature of the crystalline lens of the eyeball—the closer one is to the object, the more curved must be the surface of this lens. The altering of the curvature of the lens is managed by a ring of muscle fibers around it, within the eyeball itself, known as the *ciliary muscle* or *body*. Since the normal eye is so constructed as to see clearly (i.e., the lens is focused sharply on the retina)

when the light rays coming to it are parallel with the ciliary muscle relaxed, seeing under such circumstances involves no muscular effort or accommodation and hence no eye strain or fatigue even over a period of time. It is then only under prolonged close vision, when this muscle must be in constant use for clear sight, that weariness of the eyes, headache, etc., may result. For practical purposes, the light rays coming to the eyes from objects at distances greater than 20 feet (optical infinity) are parallel and seeing such objects consequently demands no accommodation for distance. It thus follows that for the normal eye accommodation for distance is concerned only with seeing at less than 20 feet.

But there are relatively very few normal eyes (see *normal sight)* and there are many things that can be wrong or go wrong with vision (see *defective sight).* In these cases accommodation strives to compensate and produce clear vision, but often the defect is beyond its power of correction, or even if corrected the effort involved may cause eye strain with its resultant distress (see *eye strain).* In some cases ill health may be the fault (see *disease and sight)* or perhaps some affection of the eye (see *diseases of the eye).* If so, the sooner one visits a competent eye doctor or oculist the better are his chances of recovery. But in most instances of imperfect sight and eye strain the causes lie in some refractive defect (which see) of the eyes, and for this the proper and most satisfactory remedy is usually spectacles (see *glasses).* But here, too, one must be wary in getting trained, expert attention, for charlatans infest the field of spectacle-fitting (see *buying glasses).*

In addition to accommodation, close vision requires for clearness convergence or the pointing of both eyes at the same object. This means that they must both point inward toward each other a bit, which action is achieved by the muscles on the outside of the eyeballs (see *convergence* and *muscles of the eye).*

The power of accommodation may be weakened by sickness or by general poor health. Therefore, in the interest of good sight one should strive always to keep himself in the best possible mental and physical health, resorting to medical advice as necessary. As one grows older his power of accommodation gradually becomes less (see *age and sight).* This is a

quite natural process and one which nothing can be done to halt, but correct eyeglasses will conveniently overcome this handicap.

ACID in the eye. Acids when splattered in the eye may frequently, unless *promptly* attended to, cause damage resulting in dimmed vision or even blindness. When this happens, a doctor should of course be sent for immediately, but while waiting for him to arrive and without *any loss of time* the eye should be constantly washed with quantities of clear, clean, and preferably tepid water. Drops from a dropper or the use of an eye-cup are usually inadequate for this purpose when quick and ample flushing is needed. Better to place the face in a basin of water and open the eyes, or hold the head under a faucet and let the water stream over the face and past the eyes. Avoid the use of any home remedies or alkaline eyewashes (such as the limewater once extensively employed in such instances) as they may add to the damage rather than repair it. Only such eyewashes or drops as prescribed by a physician should be utilized—for the early emergency treatment the water wash can rarely be excelled; indeed, the physician himself would use it were he there at the time.

See also *injuries to the eye* and *alkali.*

ACUITY OF SIGHT or VISION. See *normal sight* and *testing the eyes.*

AFTER IMAGES. This is an oddity of sight by which the visual impression of an object is retained for a short time after the object is no longer being looked at. Thus, if one stares fixedly at a bright object for a few minutes and then shifts his gaze to a relatively dark wall, the outlines of the object will appear to be there for a few moments. This is known as an after image. However, in most cases the image will not appear in its original color, but in its complementary color—that is, a red object will give a green image, a green one a red image, a white one a black image, etc. This is known as a *negative* after image; if it should appear in the original color, it is called a *positive* after image. This phenomenon is due to the fact that the retina is so constituted

as to retain the effect of its stimulation from light for a short time after the light is removed as a result of the bleaching out of the visual purple (which see). As the retina restores itself the image fades. After images or the retinal retention of impressions account for a revolving spoked wheel appearing as a disk, the motion in movies appearing smooth, etc.

See also *retina* and *sight.*

AGE AND SIGHT. The eye being part of the human body, it is like any other organ of the body subject to growth and alteration with age. In the great majority of cases, the eyeballs of babies at birth are too short for clear vision; that is to say, new-born babies are normally farsighted—not over two or three out of a thousand are found to be nearsighted. As the child grows, the eyeball grows and becomes longer so that normally it at last reaches a length proper for the throwing on the retina of a clear image by the lens (see *eye),* after which the eyeball should grow no more. However, it is only in the minority of persons that this happens: usually the eyeball either stops growing too soon, remains too short, and the condition of farsightedness (which see) is present; or growth continues past its proper point, the eyeball becomes too long, and the outcome is nearsightedness (which see). For mild degrees of farsightedness the power of accommodation may be sufficient to compensate and still give clear vision (see *accommodation);* but for nearsightedness there is no means of compensation within the eye and one must resort to external aids in the shape of glasses to get correct focus and vision, as is also the case for higher degrees of farsightedness.

But even those who during early life enjoyed perfect sight find that as they get older (beginning generally at around forty or so) they have increasing difficulty in seeing clearly up close, that they must hold their newspaper at arm's length in order to read it, though their vision of distant objects remains as it was. This is nothing to worry about and is a natural accompaniment of growing old. It is a result of the stiffening of the focusing mechanism of the lens of the eye (with the consequence that it cannot curve enough to throw a sharp image of close objects on the retina); the focal length of the eye lens remains permanently too long so as to throw

its image behind the retina, and the eye is farsighted. This state of affairs is known as presbyopia or "old age sight" (see *presbyopia).* It is readily remediable by correctly fitted eyeglasses.

However, all poor vision after middle age is by no means due to presbyopia. This comes on more or less gradually. Any relatively sudden dimming or blurring of vision, double vision, inflammation of the eyes, etc., may be a warning of some general bodily disease or infection, and should send one hurrying to a trained oculist for a complete examination, and thence to any specialist the oculist may indicate should the trouble prove out of his field. For the eyes, sight, and the health of the whole body are closely interconnected (see *disease and sight).*

Another danger brought to the eyes by advancing years is that of various degenerative diseases acting on the eyes themselves. Of these the most common and serious are glaucoma and cataract (which see), but even with these, the *prompt* seeking of competent medical attention holds very good promise of satisfactory relief. A regular, complete eye examination by an oculist at intervals of about a year is advisable throughout life, but especially so when one has passed middle age (see *examining the eyes).* This combined with the consistent care of general health will do much to insure good eyesight throughout life.

ALCOHOL AND SIGHT. See *drink and sight.*

ALKALI in the eye. Should lye, ammonia water, or other alkali get into the eye in any fashion, it offers a grave danger to sight unless *promptly* cared for. A doctor should be sent for without delay and the eye should be continuously washed with plain tap water (as directed under *acid)* until he arrives. It has sometimes been recommended to put boric acid solution in the eye to neutralize the alkali, but it is advisable not to use any acid wash or drops under these conditions save as prescribed by a physician, as they may readily cause further trouble instead of helping.

See also *injuries to the eye.*

ALTERNATING SQUINT. In ordinary squint or cross-eyes

(which see), one of the eyes is turned inward from its correct visual axis so that normal binocular vision is not obtained (see under *sight)* and double vision results. Usually the sight in the turned eye becomes spontaneously suppressed or ignored (in order to avoid the double vision) and that eye may in consequence tend to deteriorate. To counteract this, various means have been employed to bring the shirking eye back into use (see under *cross-eyes).* However, in alternating squint the defect is not localized in one eye, but shifts back and forth from one to the other, thus making treatment very difficult. Dr. F. W. Brock has evolved an ingenious method of treatment in which he places a red glass before one eye and a green glass before the other and has the patient look at a special chart of combined red and green figures so that both eyes must constantly be used since neither can do the work of the other. In this way each eye gets the necessary exercise and training needful for overcoming the muscular imbalance causing the trouble.

See also *orthoptics.*

AMBLYOPIA. A general term for dimness or impairment of vision, especially when there is no discernible defect or injury in the structure of the eye or the optic nerve. Excessive use of tobacco and alcohol will bring it on, as will certain other drugs and poisons.

AMETROPIA. A general term for the refractive errors of the eye by which defective sight is occasioned by some imperfection in the refracting or focusing portions of the eye. This includes nearsightedness, farsightedness, and astigmatism (see each).

Andre Permanent Lash and Brow Dye. A patent eyelash dye condemned as dangerous. It contains aniline dyes and would consequently, should any of it find its way into the eye, be likely to produce serious irritation there and could result in impaired vision or even blindness. Products of this sort must *never* be employed.

See also *beautifying the eyes* and *quackery and fraud.*

ANSEIKONIA. A relatively recently discovered sight defect in which one eye sees an object as smaller than does the other.

APPEARANCE AND GLASSES. For the very great majority of sight deficiencies glasses provide a blessed relief and remedy, as simple as it is satisfactory, which restores to one a workable vision very close to normal in most cases. With them a person may at will literally "pin on" good eyesight as readily as an ornament or a flower. Yet there are surprisingly many who persistently resist this almost God-sent boon. A few there are who through misinformation believe glasses to be further deleterious to sight, regarding them as "crutches" which support the eyes and encourage them to grow weaker. Such persons require usually only a little patient explanation of what the eye is and how it works to straighten them out. But the mass of "glasses resisters" are those who refuse them for reasons of vanity, fearing that glasses spoil their beauty. By far the worst offenders in this are, of course, women. Such an attitude implies that it is more important to be seen than to see.

With a little care and thought one may enjoy the benefits of glasses without sacrificing appearance. This endeavor has two main aspects: the choosing of the style of glasses; and the choosing and arrangement of one's make-up, clothing, and dress in general so as to *include* the glasses and make them part of the ensemble, instead of ignoring the glasses and making them conspicuous. In both of these directions there are many individual elements with which each person must experiment to find the best solution, but there are a few broad, general rules which can be stated for all.

So far as style of glasses is concerned, there are many to choose from, subject to the fads of the moment (as for example the new "Harlequin" frames in many gay colors with the slant-eyed shape that is supposed to give a young, impish appearance) and the resources of the optician's stock. Naturally, first thought should be given to utility and safety and a frame chosen best suited for one's type of work (see *buying glasses*). If this consideration forces one to take frames too unbecoming, a second, more attractive set could be had for evening and social wear. Glasses may be chosen from two angles: having them as inconspicuous as possible, or considering them an ornament (as earrings, necklace, etc.) and building one's make-up, hair-do, etc., around them. If the first

approach is used, the glasses should be rimless or with very thin, light-colored rims, and the temples to the ears should be thin. Pince-nez glasses, despite their compactness and lack of trimmings, will scarcely do here because their "perch" on and pinching of the nose and the constant "fiddling" that is done with them serves to draw attention to them. But if the ornament angle is followed, the frames should be picked for pleasing and harmonious conspicuousness, as one would costume jewelry. Here the Harlequin frames might well be worked in, especially with sports outfits. If one strives for the intellectual appearance, the heavier, tortoise-rim frames may be employed, or the pince-nez, especially for older persons. If one's features are embarrassingly plain, unwelcome attention may be drawn from them with some of the huge, thick, outlandish frames, and the rest of one's costume may be made correspondingly unconventional to carry out the motif. The possibilities are almost endless, as a visit to any large, up-to-date optician's shop will demonstrate. But the frames once chosen, their fitting, the placing of the lenses in them, etc., also demand care. If the lenses are too small, they give you "shoe-button" eyes; if they are too large, they give you the bulging "bug-eye" effect or make you look forever amazed. If they are set too close together, they make you look ill-tempered and frowning; if too far apart, you take on a simple, child-like air. If they are too low, you appear always tired; if too high, you take on an over-serious, peering expression. Your desires in these matters should be made known to the optician before the lenses are ground, for they can be ground so as to be set in any direction and still be optically correct.

As for make-up, this should be governed according to the manner in which the glasses are being treated. If they are to be made as inconspicuous as possible, the make-up should be such as to draw attention away from them and not toward them. Keep the rouge on the cheeks low and back, not high and near the glasses. Make up the mouth neatly but strikingly so that it becomes a focus of attention instead of the glasses. Keep the hair-line soft and moderately fluffy, bringing it down on the sides to hide the spectacle temples as much as feasible; do not have a straight, hard, framing line or a tight, pulled-back effect. Do not wear confusing, eye-catching, bright

and glinting ornamentation about the face or throat—long, swinging earrings, massive necklaces, frilly bows and ribbons, etc.—as these knick-knacks combined with the glasses already there will give the face a crowded appearance. Keep the eyebrows neat and well cared-for, and have their line harmonize with the outline of the glasses, not clash with it.

If the glasses are to be among one's chief dress ornaments, care should be taken to keep the rest of the dress and decoration in harmony and the same mood, and there should be no other important focus of ornamentation to vie for interest with the glasses and detract from their emphasis.

See also *beautifying the eyes.*

AQUEOUS HUMOR. This is the clear, watery liquid that fills the anterior chamber of the eyeball, the space between the cornea and the crystalline lens. It and the *vitreous humor* supply the "filling" in the space in the eyeball not taken up by the sight mechanism.

See also *eye, sight,* and *vitreous humor.*

ASTIGMATISM. One of the errors of refraction of the eye that produces imperfect vision and eye strain. It is due to an irregularity in the curvature of the cornea in certain meridians of the eye. (Meridians may be pictured as lines drawn at various angles on a piece of paper held before the eye so that all the lines cross each other at a point exactly before the pupil of the eye.) In ordinary nearsightedness and farsightedness the defect is the same in all meridians. Astigmatism may occur in combination with either nearsightedness or farsightedness. It may be the result of injury to the eye, but most commonly is caused by a natural deformity in the shape of the cornea. Almost every one has some degree of it. There is also a rare form—known as lenticular astigmatism—produced by a defect in the lens of the eye. Astigmatism causes blurred vision in certain planes, usually the horizontal or vertical, and lines of objects at certain angles appear darker than those at others. The attempt of the eye to compensate for this and give a clear image forces on it a constant muscular effort productive of eye strain, headaches, fatigue, etc.

A simple test for astigmatism is to look at an object with one eye only and then to look at it with the same eye through

a pinhole in a card; if vision seems improved in the second instance, astigmatism may be suspected. Or if upon looking at a chart having a number of radiating lines of the same density (with one eye at a time) some of the lines appear darker than others, this defect may again be suspected. Naturally one will immediately visit an oculist for a complete examination in such an event and have him prescribe suitable glasses.

The only remedy for astigmatism is glasses, and they must be carefully prescribed, made, and fitted by experts, for this is a defect which incorrect glasses can very much aggravate. Whereas the ordinary eye imperfections need only simple spherical lenses (which are the same in all meridians), astigmatism calls for a cylindrical lens (which in principle is merely a slice taken lengthwise from a glass cylinder) the axis of which must be correctly placed before the eye so that it compensates in the meridian in which the defect lies. For this reason, astigmatic persons should never have spectacle frames with round lenses as the lenses may become turned in the frames, throw the cylinder out of its proper meridian, and cause distress.

See also *refractive defects, eye, sight, glasses* and *lenses.*

ATHLETICS and defective sight. See *sports.*

AUTOMOBILE DRIVING and sight. The need for good eyesight for driving, not only in the interest of one's own safety but also that of others on the highway, is self-evident, and any one with seriously sub-normal vision should not in ordinary fairness attempt it. However, in most cases ordinary care and precaution will enable such a person to enjoy the use of a car safely. The first and most important precaution is to obtain glasses that will restore vision as nearly to normal as possible, and to wear these glasses *always* when driving. If they become lost or broken, the car should not be driven until new ones are got. If one's defect is such that glasses will not give serviceable vision, all thought of driving should be given up. Naturally, fast driving in heavy traffic or under conditions calling for fine distance judgment should never be considered. Night driving ought to be avoided when possible as the general obscurity, flashing lights, and confusing re-

flections will add to one's difficulties. This last is especially applicable to those afflicted with night blindness (which see). Drivers with defective eyesight are likely to be troubled by the glare of approaching headlights and their recovery from the blinding effect when the lights are past will usually be slower than normal, leaving a dangerous interval of temporary blindness. Some drivers report success in combating this by closing one eye when bright lights approach and opening it again when the lights are past, which eye then gives vision until the other one recovers. Tinted glasses may be of aid against lights, but they might hinder adequate vision at other times. Polaroid glasses will not stop direct glare, but they will cut out reflected glare, so one might wear these and train himself to watch the highway in front of the approaching car (guiding himself by the dividing line) and not look into the headlights. Such precautions may also well be employed by drivers with normal sight. It is also advised that persons who wear no glasses might well, especially when driving open cars during daylight, wear goggles or tinted glasses to escape the whipping of the eyes by wind and dust with consequent irritation and inflammation, and to avoid eye strain from squinting against the sunlight.

Color-blindness offers a special hazard in driving in that it may make it impossible or difficult to detect traffic or danger signals or warnings. Red tinted glasses would, of course, enable a color-blind driver to see a red light when on (though he would see it only as a light and not as red). There has recently been put on the market a special type of spectacle for color-blind drivers, the upper fourth of the lenses of which are made of dark red glass; by looking through these portions at signals the driver knows that when he sees a light through them the red light is on.

BABY'S EYES, care of. Very much of adult vision impairment and blindness may be traced to parental carelessness or ignorance regarding simple cares and precautions with their children's eyes during the early days of their life. Indeed, a conscientious mother who desires the best possible eyesight for her child will take steps to insure it even before it is born, during pregnancy (see *prenatal care).* The first safety measure

consists in putting into the baby's eyes, as soon after birth as feasible, a few drops of silver nitrate solution. This, of course, must be done only by a trained person, the doctor or midwife. This simple treatment (discovered by Dr. Karl Crédé) counteracts any infection (usually gonorrhea) that the baby's eyes may have picked up from the mother in the process of being born, which condition is known as *ophthalmia neonatorum*, and has been instrumental in reducing child blindness from this cause by over 75%. In most states the doctor or midwife is required by law to administer it, and it will do no harm for the parents to inquire at the earliest opportunity if it has been done.

At birth, practically all babies are farsighted; that is to say, their eyeballs are short because of their general small size. This they normally grow out of. The newborn child probably sees little but light, and perhaps large, vague outlines. They have to learn how to focus before they can see clearly. However, if by the time they are six months old their eyes do not consistently follow a hand moved slowly back and forth about 14 inches before their eyes, or if they do not with a reasonable degree of accuracy grasp a bright object placed before them, it may be that there is something wrong with their eyes or the mechanism of accommodation and they should be put under the care of an oculist without delay. There is no eye trouble that does not benefit from the earliest possible expert attention.

In learning to accommodate, babies' eyes sometimes overdo it and there may be a turning in or out of one of them, producing cross-eyes. Often this is only temporary, especially if the child is tired, and will recover of itself; but if it persists for any length of time the oculist should be seen, never delaying more than two weeks at most. The correction of cross-eyes is a much simpler matter in children than it is if allowed to persist until adulthood. It is a bad practice to dangle or hang any bright object before young babies' eyes (as some mothers hang things from the hood of the go-cart) as this will aggravate any tendency in the eyes to cross as well as cause eye strain in the child through the induced constant close focusing.

There are also a number of small but important daily pre-

cautions that do not even occur to the average parent. The child should not be subjected to sudden changes from darkness to bright light and should not be left to play or sleep where a bright light or sunlight can fall into his eyes. The eyes should be protected from extreme cold in the winter. Nor should the baby be permitted to remain in a room where there is much smoking going on, as often happens—this is harmful enough to adult eyes. Sharp or pointed objects or toys are to be kept out of baby's reach. And his fingernails must be kept short and smooth; not only might he scratch and infect his own eyes, but also those of a person picking him up or holding him. If "drops" are to be put into the eyes (and positively *only* those prescribed by a doctor are to be considered) it must be done with great caution so that the dropper does not touch the eyeball and perhaps scratch it. If styes appear (as often they do in young children) they must *never* be pressed or squeezed. The only permissible home treatment is a pack of *clean* cloth soaked in warm water. To this styes will frequently yield; if not, the doctor must be consulted for further treatment. Too many styes in a baby may indicate that he is rubbing his eyes (a bad practice) or is not getting a proper diet, either of which should be rectified. In older children they may signify eye strain and the possible need of glasses, which is a matter for the oculist to decide.

See also *children's eyes* and *care of the eyes.*

Barker System. A quack system of eye exercise and massage for "strengthening" the eyes, plus other alleged benefits. Naturally, this system, as set forth in a booklet the sale of which constitutes the income of the business, can do nothing of the sort.

See *exercise* and *quackery and fraud.*

Bates, W. H. Though a graduate of a recognized medical school, Bates enjoys the dubious honor of being the patron saint of the multitude of charlatans who prey upon the numerous persons whose vanity or convenience prompts them to seek to escape the need for wearing glasses. He concocted a system of treatment (set forth in his book *Perfect Sight Without Glasses,* which has become the Bible of the quacks in this field)

by eye exercises, massage, exposure to bright light, etc., which he claimed would overcome *all* visual defects, even errors of refraction! The impossibility of such a thing is obvious to any one with a slight knowledge of the eye and its workings. Bates died in 1931, but his evil influence persists.

See also *"sight without glasses," exercise,* and *quackery and fraud.*

BATHING THE EYES. See *washing the eyes.*

BEAUTIFYING THE EYES. The desire to appear beautiful (especially according to some groundless standard of fashion) has cost many women a large part (in some cases, all) of their sight. Vanity and the concern over one's facial beauty prevents many from enjoying the benefits of glasses (see *appearance and glasses),* which neglect may aggravate the eye defect. But even more foolish is the frequent risking of sight and the health of the eyes in the inconsidered attempt to beautify them with cosmetics or other beauty measures. This is no mere remote, potential danger; its reality is amply attested by the records of eye injuries and even blindness stemming from this source.

The primary danger of all eye cosmetics lies in the likelihood of their finding their way into the eyes and there causing irritation, inflammation, or even infection. Mascara and certain black eyebrow pencils *may* be considered relatively harmless since they contain usually only lampblack in a wax and mineral oil or soapy base. But even these inert substances, once they get into the eyes, constitute foreign bodies conducive to irritation. Besides, anything drawn into the eye carries the possibility of infection, and the irritation it may produce renders the eye more susceptible to infection.

But mascara and brow pencils are the *positive limit* of eye cosmetics that are even to be contemplated. *Never* under any circumstances are lash or brow dyes to be thought of. Besides offering all the dangers of irritation of the above, many of them have in addition as their active ingredient a silver or lead salt or an aniline dye any of which not only can, but in recorded instances *has,* produced sight impairment in degrees varying all the way to total blindness. This certainly is an extreme price to pay in the pursuit of some dubious standard

of beauty. The continued use of eyelash preparations containing aniline dyes may even lead to death. The worst offender of this type, and the most widely advertised and sold, is the product known as *Lash-Lure.* Some of the other dangerous lash and brow preparations are: *Phantom Brow, Ey-Tec, Larieuse, Inecto Rapid Notox,* and *Andre Permanent Lash and Brow Dye.* This is by no means a complete list—avoid them all!

Though dyes offer the worst hazard to the eyes, there are other types of preparations to be guarded against. The products purporting to grow long lashes (as *Lashgro,* etc.) may or may not be harmful, but certain it is that they are a complete waste of effort and money for they will accomplish absolutely nothing. To date, scientific medicine has discovered no safe, certain means of promoting the growth of hair, so it is extremely improbable that patent medicine has done it.

There are also preparations on the market to make eyes "bright and lustrous"—never touch them under any circumstances! In this connection may be mentioned the formerly rather common practice (still persisted in by some women) of putting belladonna into the eyes to give them a "wide-eyed" intriguing appearance. Belladonna contains atropine and will in fact dilate the pupils noticeably (it is used by oculists for this purpose in examination), but its habitual employment will prove definitely harmful.

Eyebrow plucking and shaping is a beauty measure that may be indulged in with reasonable safety if care and cleanliness is observed. However, the methods should be limited to plucking or shaving. The use of depilatory pastes or liquids is to be rejected because of the potential danger of accidentally getting them into the eyes. Nor are abrasives to be recommended because of the possibility of irritating grit dropping into the eyes.

The most effective measures for eye beauty are the safest. Proper, regular resting of the eyes will do much to prevent wrinkles and give them a calm, clear appearance. When doing close work, reading, sewing, or the like, train yourself to look up at a distant object for a few moments at about 15-minute intervals. If you need glasses, wear them, for deficient eyes make an unconscious, constant effort to see, and this will result in a wearied, puckered look. Correct rest, diet, and general

living habits will be reflected in the eyes. Protect them from the irritation of wind, dust, glare, tobacco smoke, etc. (see *sunglasses, goggles,* and *care of the eyes).* And, finally, should any inflammation, pain, or distressing symptoms develop in the eyes, visit a competent oculist *promptly.*

See also *quackery and fraud.*

BEAUTY AND GLASSES. See *appearance and glasses.*

BED, READING IN. See *reading in bed.*

Better Vision Institute. An organization, located at 630 Fifth Avenue, New York City, for the purpose of disseminating information on and encouraging work in the conservation and improvement of the nation's eyesight.

BIFOCAL LENSES. With these lenses in his spectacle frames, one enjoys the convenience of two pairs of glasses (one for close work as reading, and the other for ordinary distant vision, as in moving about the streets, etc.) without the bother of carrying two sets and changing from one to the other as occasion demands. They are a boon in particular to older persons whose presbyopia causes them to need aid for both distant and close vision. They are simply portions of the two different lenses that would be required by the individual for near and far vision, put together so as to form in outline a single lens. Since in doing close work one almost invariably looks downward, the lower portion of the bifocal lens is ground for that purpose; and most of distant vision being directed straight ahead, the upper portion is designed for that. Benjamin Franklin is given credit for having invented bifocals. He got tired of changing from one set of glasses to the other, so he cut the lenses of both in half and cemented the proper lower and upper portions together in his frame. For a long time bifocals were made in much the same manner, save that the lower close-vision segment was made smaller than half, rounded off, and fitted neatly into a corresponding space cut into the distant lens. Today we have machines that can grind the two different segments directly into the same blank or piece of glass, thus getting rid of that tell-tale joint. Another clever device sometimes used is to grind a carefully

calculated depression into the lower portion of the crown glass blank, fuse in a piece of fitted flint glass, and thus when the blank is ground to the distant prescription, the lower portion compensates for close vision through the higher refractive index of the flint glass.

Bifocals must be carefully prescribed, ground, and fitted, else they may prove more trouble than benefit. The size of the segments should be right so as not to cause undue tilting of the head. They are most satisfactory for elderly persons, about 50 or older, and they require a period of patient trial in order to learn automatically to use them properly. They should be fitted with the tops leaning outward a bit so that vision through the lower segment when reading is not at too great an angle, which will cause blurring. The best of bifocals compensate for only two distances: usually reading distance and street distance; moderately close vision (as 3-4 feet) may still be difficult. But bifocals can be ground for any two major distances, so if one does much work at, say, arm's length (as a painter) he can have his oculist prescribe them for this and street distance, or for this and reading distance, as his greatest need demands. There has recently been developed "trifocal" lenses whose lower and upper portions are for reading and street distances and the center portion for moderate distance. Such a lens, of course, would require rather accurate adjustment of the angle of the head in order to see through the proper segment. This head and line-of-vision adjustment is the chief drawback to bifocals, so much so that if one does a great deal of close or arm's length work he may find it advantageous to have a second pair of glasses ground solely for that distance.

See also *glasses, lenses,* and *care of glasses.*

BINOCULAR EFFECT of the eyes. See under *sight.*

BLACK EYE. This is due to the escape and collection, under the skin of the eyelid and area surrounding the eye, of blood from capillaries and small veins which have been ruptured by a blow across or very near to the eye. The blood in the veins being black, the bruise is naturally black; the arteries with their red blood are stronger and usually resist rupture. The bone being close to the skin around the eye socket, bruis-

ing occurs readily there. In itself, a black eye is not especially serious, though frequently embarrassing. The only real danger is if the blow giving it has been violent enough to cause injury to the eye itself. Ordinarily, the eyeball is set back in its socket well enough to be protected from the average blow by a large object, as a fist or the inevitable door in the dark, but if the eye appears to have been hurt, an oculist should be seen.

The treatment of a black eye is that of any bruise. The first step is to attempt to stop the flow of blood under the skin *as soon as possible*. This is best accomplished, immediately after the blow, by the application of moist, cold packs over the eye, changing the pack as soon as it warms. After some time has passed, at least 8-10 hours, hot bathing or packing of the eye may be done, followed by *gentle* massage of the bruised portion about the eye; this aids the absorption of the blood by the lymph. But heat must *not* be applied soon after the blow as this would aggravate matters. The use of the proverbial raw beefsteak is a waste of good food; its only possible value lies in how closely it simulates a cold, moist pack. There is no satisfactory immediate remedy. If one must make a public appearance, the best solution is to have the bruise painted out by a make-up artist.

See also *injuries to the eye*.

BLENNORRHEA. A severe form of conjunctivitis (which see) due to gonorrheal infection and accompanied by a more or less copious flow of mucus from the eye. Treatment demands expert medical care, not only of the eye, but of the gonorrhea as well.

BLEPHARITIS. Inflammation, redness, and soreness of the edges of the eyelids. Besides the discomfort, this condition may cause eye trouble, impairs appearance, and usually causes the eyelids to be stuck together upon awakening in the morning. It is often found in children and may be the extension of some contagious skin affection, and is frequently associated with defective vision, general poor health, and improper diet, especially as regards vitamins and minerals. Treatment generally consists of (besides correcting any of the above conditions present) keeping the eyelid edges clean

and free of crusts by the use of a suitable wash, and perhaps the applications of certain ointments or medicaments, all of which of course must be done only under the direction of a physician.

See also *eyelids* and *diseases of the eye.*

BLEPHARO-SPASM. In this condition there is a strong, involuntary, spasmodic closing of the eyelids, especially in the presence of bright light or upon the approach to the eyes of a physician's instruments, etc. Since a frequent cause of this is ulcer of the cornea, a very serious condition, any one exhibiting this symptom should see an oculist without delay.

See also *eyelids* and *diseases of the eye.*

BLIGHT. A common term sometimes applied to conjunctivitis or "pink eye."

BLIND SPOT of the eye. This is the relatively small portion of the area of the retina at which the nerve fibers of the optic nerve, entering the rear of the eyeball in a bundle, spread out over the retina where each terminates in a light-sensitive rod or cone. Since there are no rods or cones in this spot and the optic nerve itself is insensitive to light, the spot is consequently blind and the brain is unable to receive any visual impressions of that portion of images cast upon it in the process of seeing. In ordinary seeing this spot is never noticed as the one eye will see that portion of an object whose image falls on the blind spot of the other. Also each eye, or perhaps more properly the brain, tends instinctively to "fill in" the missing portion from the context and from experience. The presence of this spot may be demonstrated by several simple experiments. One is to close one eye, hold a pencil with a bright top about 14 inches from the eye, and move it slowly outward a little below the line of vision, keeping the eye directed forward and not allowing it to follow the pencil; at a certain point, when its image enters the blind spot, the top will disappear from sight. Another is to take a plain white card, mark a heavy, black dot in the center, and make a tiny cross-mark about 1¼ inches on each side of the dot. By closing the left eye and bringing the card slowly toward one with the right eye fixed on the dot, a point is reached at

which the cross disappears. The other cross will do the same when the left eye is used.

BLIND SPOTS in vision. See *scotoma.*

BLOODSHOT EYES. This is a condition of notable redness, usually more or less in patches, of the white of the eye. It is the result of the rupture of some of the tiny blood vessels under the conjunctiva, which rupture may be brought about by exposure to smoke, dust, wind, or other form of direct irritation, by prolonged eyestrain, by some bodily illness or disturbance, by a violent shock or effort, as sneezing or vomiting, by over-indulgence in alcohol or drugs, etc. Deficiency in vitamin B_2 is also said to encourage it. Though often alarming in appearance, this condition is usually not especially serious and will ordinarily clear up spontaneously in a few days. Cold bathing of the closed eye may aid this. Any lotions or washes used should be prescribed by a physician. If bloodshot eyes occur too frequently without apparent cause and remain too long, they may be evidence of an eye defect that needs correction or of some systemic disturbance requiring treatment, so a competent physician should be consulted.

See also *injuries to the eye, diseases of the eye,* and *care of the eyes.*

BLURRED SIGHT or VISION. Vague, fuzzy vision may occur temporarily as a result of eye fatigue, over-indulgence in drink, upset stomach, or the like, in which case it is ordinarily of little significance save to warn that one should be a little more cautious in the direction in which the fault lies. But if the blurredness is persistent, it is an indication that something is definitely wrong and should be corrected at once. The trouble may lie in the eye itself, either in the imperfect function of the focusing mechanism (see *refractive defects* and *accommodation),* an affection of some part of the eye, as the retina, lens, iris, etc. (see *diseases of the eye),* or in some disorder of the sight nerves or their connections in the brain (see *nerves of the eyes).* Or it may be occasioned by some general sickness or infection of the body (see *disease and sight).* Whatever the cause, treatment of some sort will be neces-

sary (glasses, medicine, surgery), and the sooner a suitable oculist or physician is consulted the better is the prospect of recovery.

See also *sight* and *defective sight*.

BOOKS on the eyes, sight, etc.

(This short list is intended only to be suggestive for those wishing to seek further information. It makes no pretense of being even remotely complete.)

PAMPHLETS

The following are inexpensive and offered for sale by the American Medical Association, 535 N. Dearborn St., Chicago, Ill.:

S. I. Kaufman, *Your Eyes: What to Do When In Trouble.*
E. Jackson, *Eye Physicians, Opticians and Their Work.*
W. B. Lancaster, *Wearing Glasses.*
J. R. Burke, *Should Your Child Wear Glasses?*
J. R. Burke, *First Eyeglasses at Middle Age.*

The following are offered free:

Care of the Eyes—on request to Metropolitan Life Insurance Co., One Madison Ave., New York City, Booklet Department;
Eyes—published by the Guild of Prescription Opticians, and obtainable on request from any Guild Optician, in most large towns.

The following organizations offer information on request concerning the eyes, their care and treatment, and the conservation of sight:

National Society for the Prevention of Blindness, 50 West 50th Street, New York City;
New York State Commission for the Blind, 205 East 42nd Street, New York City;
Better Vision Institute, 630 Fifth Avenue, New York City.

GENERAL AND POPULAR BOOKS

Park Lewis, *What You Should Know About Eyes,* Funk & Wagnalls Co., New York, 1937;
O. G. Henderson & Hugh G. Rowell, *Good Eyes for Life,* D. Appleton-Century Co., New York, 1933;
H. G. Merrill & L. W. Oaks, *Your Vision and How to Keep It,* Putnam's, New York, 1931;
E. S. Thomson, *Your Eyes and Their Care,* D. Appleton-Century Co., New York, 1929;
Louis Resnick, *Eye Hazards in Industry,* Columbia University Press, New York, 1941;

S. W. Newmayer, *First Aids In Reading Difficulties,* North American Printing Co., Philadelphia, 1940;
E. A. Taylor, *Controlled Reading,* American Optical Company, Kansas City, Mo., 1937;
M. Luckiesh, *Seeing and Human Welfare,* The Williams & Wilkins Co., Baltimore, 1934.

TECHNICAL BOOKS

S. H. Bartley, *Vision, a Study of Its Basis,* D. Van Nostrand Co., New York, 1941;
M. Luckiesh & F. K. Moss, *The Science of Seeing,* D. Van Nostrand Co., New York, 1938;
N. A. Stutterheim, *Eye-Strain and Convergence,* H. K. Lewis & Co., London, 1937;
Chas. H. May, *Manual of the Diseases of the Eye,* 15th ed., William Wood & Co., Baltimore, 1937;
V. W. Grant, *Psychological Optics,* The Professional Press, Chicago, 1938;
T. G. Atkinson, *Oculo-Refractive Cyclopedia and Dictionary,* The Professional Press, Chicago, 1938.

BORACIC ACID. *Boric acid,* which see.

BORIC ACID. This white, crystalline substance of extremely mild acidity and gentle antiseptic properties has had a good deal of use in solution as a general eyewash for routine bathing of the eyes, mild irritations, inflammations, flushing out foreign particles, etc. The solution for such purposes is usually made by stirring one teaspoonful of the crystals into a glass of boiling water, allowing to cool, and pouring off the clear liquid. Though this has long been considered in many quarters as the standard home eyewash, there has of late been some doubt cast upon the advisability of even this gentle agent; there has been some evidence that its habitual use may produce a chronic conjunctivitis. However, employed occasionally for flushing out the eye, removing dust, etc., it is not likely in most cases to produce any adverse effects, but as much benefit may be had by doing the bathing with plain tap water, boiled and allowed to cool. For simple irritations of the eye it is held by many authorities that normal saline solution (made by dissolving two teaspoonfuls of table salt in a quart of boiling water) is best and safest; as this approximates the composition of tears, nature's own eyewash, it is likely to prove suitable. Except for what has been given here

and with the reservations noted, *no* eyewash, lotion, or "drops" of any sort should be put into the eyes save on a doctor's prescription. Beware especially of all patent, commercial eyewashes and medicines.

See also *eywashes* and *care of the eyes.*

BULBS, ELECTRIC. See under *lighting.*

BULGING EYES. The abnormal protruding of the eyes from their sockets may be merely a personal characteristic, especially in very corpulent people, and as such is of no particular significance; but often it is an indication of disease, generally of the endocrine glands, and consequently requires competent medical attention (see *exophthalmos).* When only one eye bulges, there may be some serious disorder in the orbit behind it, and an oculist should be consulted at once.

BUPHTHALMOS. A form of glaucoma found in young children, due to some defect in the development of the eye (see *glaucoma).* It is also known by the common term "ox-eye." Prompt surgical attention by an oculist will often save at least part of the sight.

BURNS of the eyes. See *acid, alkali, tear gas.* See also *injuries to the eye.*

BUYING GLASSES. The proper, safest procedure to follow in obtaining eyeglasses, once the need for them has been established, is as follows: Go to a reputable, well-trained and experienced oculist (your family physician can usually recommend one) for a thorough examination. The oculist will not only determine the nature and degree of your visual defects and write you a suitable prescription for lenses to correct them, but will at the same time ascertain if there are any disease conditions in the eyes that require treatment (see *examining the eyes).* This lens prescription is then to be taken to a reliable optician with modern equipment (one or several can usually be recommended by your oculist or physician) who will grind the lenses accordingly and fit them to frames. The frames you may choose yourself as to style or type according to beauty (see *appearance and glasses),* utility, safety, etc.,

but the size should be decided upon by the optician after taking measurements of your face. It is well to listen to his advice in the other matters also. After the lenses have been ground and the glasses fitted on the face, go back to the oculist to have him check the correctness of the lenses and the fit of the frames.

The majority of glasses are bought in this country through optometrists who not only examine the eyes and write the prescription, but also in the same shop sell you the frame and lenses, which lenses they may obtain wholesale from an optician or in some instances grind themselves. While there are many ethical optometrists, there are many dishonest ones (see *optometrists*). This condition makes it safer to follow the procedure outlined above. Besides, even the most honest optometrist is not trained or licensed to practice medicine. Therefore in his examination he may overlook symptoms of eye diseases that may be present and apparent to an oculist, neglect of which may prove more serious than the defect of vision that sent you there. However, there must not be confusion between optometrists and some properly trained oculists who do a certain amount of their own lens and frame fitting, edge grinding, etc., depending on the amount of equipment they have available. The same care should be exercised when having glasses changed or broken lenses replaced.

In addition to the above, one will be wise to keep in mind always the following warnings:

Beware of shops advertising "Free Examination," "Glasses on Easy Credit," etc. What is apparently "free" is generally paid for indirectly many times over and, since a man must live by his profession, it stands to reason that services got for nothing are usually good for nothing.

Beware of optical "chain" stores with their policies of mass purchasing of merchandise when the price is "right," big turnovers, high-pressure advertising and salesmanship, etc.

Avoid big department stores, jewelry houses, and the like whose optical shops are merely a side line to their main business.

Never even consider the offer of "cheap" spectacles by mail-order.

Have positively *nothing* to do with the glasses obtainable from five-and-ten stores or from peddlers, where you keep trying different sets until you find one that seems to "fit."

Finally, be wary of buying too cheap glasses (see *price of glasses*). Cheap materials are often defective materials.

See also *glasses*.

CARE OF GLASSES. Once the correct glasses have been obtained, the satisfaction and service from them will be dependent largely upon the care given them. Glasses are really delicate optical instruments doing precision work, yet the average person treats them as if they were a rugged tool.

The most frequent attention they require is that of keeping them clean. This should be done without scratching the lenses or bending the frame. Various things have been recommended for this (alcohol, ammonia, etc.), but there is nothing better, more accessible, or cheaper than plain water with a little soap dissolved in it. A bottle of soap water may be made up and kept handy for this purpose. It is sometimes asserted that a little glycerine added to this mixture improves it. A few drops of this placed on the lenses, rubbed briefly over them with the fingers, rinsed off in clear water and the lenses dried and polished with a clean, soft, lintless cloth, will give sparkling results. An old linen handkerchief is excellent for polishing. Some of the disposable paper tissues will also serve well. There are available some tissues especially prepared for this purpose (as *Clean-omist)* which do a good job, but they scarcely warrant the extra expense. While polishing the lenses, and especially the rimless variety, avoid holding them in such a manner as to bend or loosen the frame; it is safest to hold the lens being polished between the fingers by its edges or by the mounting of the temple or ear-piece—never by the bridge of the frame. This also keeps finger-prints off the lenses. While out and about during the day, the lenses may be wiped with a handkerchief, either dry or after "huffing" on them with the mouth; but if any gritty dust is on them it is best to wait until they can be rinsed in water for fear of scratching their surface.

Cleanliness applies to frames as well as lenses. This is one of the commonest neglects of spectacle wearers. This is easily and thoroughly taken care of by periodically immersing the entire frame, temples folded, in a suitable jar with a screw

lid filled with soap water, swirling gently from time to time, rinsing, and drying carefully.

After dirtiness, the most frequent fault is scratching of the lenses. This is done usually by thrusting the glasses carelessly into a pocket or handbag without putting them in their case, by laying them down (as at night, while washing, etc.) on their faces, or by improper cleansing (as described above). When carried elsewhere than on the face, glasses should *always* be in a suitable, soft-lined case. And this case should be changed from time to time, as eventually the lining picks up and holds grit that will scratch. When the glasses are laid aside at home, place them on their upper edges with the temples extending along the table—*never* place them on their faces with the temples up. If the temples are for any reason folded, lay them on the folded temples; but the temples should not be folded when avoidable as this tends to get the frame out of correct adjustment.

It is important to avoid bending the frames from their original position; to do so changes the location of the lenses before the eyes and interferes with vision. When removing glasses, never pull them off carelessly by the lenses or by taking hold of one temple and "peeling" them off. Instead, grasp both temples just ahead of the ear hooks and lift them carefully from the ears, keeping them close to the head and avoiding spreading them. If the frames become out of adjustment, they should be straightened at once by your oculist. Indeed, they should be checked by him periodically even if nothing seems wrong, preferably twice a year as to frames and once a year as to lenses.

See also *glasses* and *wearing glasses.*

CARE OF THE EYES. The attention due the eyes in the interest of their preservation and health and the conservation of sight, is of two major sorts: remedial and precautionary or protective.

If the eyes already suffer from some defect or affection, which may or may not cause impaired vision, the only sensible course is to cure the condition if possible, or make such corrections for it as are feasible. Defective sight brought about

by errors of refraction (see *refractive defects*) may at times be treated to prevent their growing worse, but its only satisfactory remedy is by means of glasses (see *glasses*). Poor or double vision due to muscular imbalance can usually be handled by glasses or by suitable exercise (see *cross-eyes* and *orthoptics*). Disease or injury of the eyes may or may not bring on deficient vision according to circumstances, but they always demand prompt medical or surgical treatment (see *diseases of the eye* and *injuries to the eye*). If the disease or injury ends with a partial loss of sight, help may usually be had from correctly fitted glasses.

But even more important than the above is the protection of the eyes to prevent anything going wrong with them or, if they are already ailing, to keep them from getting worse. The precautions one should exercise in the interest of his eyes are of various sorts, but none is especially difficult or trying. Foremost among them is the avoidance of any sort of persistent eye strain, since few things can as surely lead to bad eyesight and general distress (see *eye strain*). If strain is the result of some refractive or muscular defect, corrective glasses are of course indicated. The next commonest source of eye strain is over-use of the eyes, especially for close work, as reading, writing, sewing, etc. The eyes will be saved much wear and tear if these tasks are performed correctly and it is unfailingly remembered to rest the eyes periodically (see *reading, writing,* and *resting the eyes*). In particular should one guard against overworking the eyes when he has passed middle age as they then begin to lose some of their elasticity and power of accommodation (see *age and sight*). The correct amount and kind of light is indispensable for any work, close or distant, if eye fatigue is to be prevented (see *lighting*), but there must be equal precaution against subjecting the eyes to any glare (see *glare* and *sunglasses*).

A constant danger to all eyes is injury from any of a great number of sources. While greatest in certain industries, it is by no means absent in the home, walking in the woods (where branches may strike the eyes), games and sports, or attending to one's daily business. Doing away with or avoiding the things that endanger the eyes, developing habits of conduct by which the eyes are instinctively shielded, or wearing some

form of protection where the hazard is great, are among the best solutions (see *injuries to the eyes* and *goggles*).

Protection against infection and eye disease is similarly important. Rubbing the eyes with dirty fingers, using towels in common with other persons, scratches on the eyeball, foreign bodies in the eye, and a host of other possibilities may introduce infections in the eye that may end in loss of sight, especially if untreated. Most eye diseases begin unobtrusively and cause little pain or other symptoms, but many of them can if unchecked end in blindness. In all these cases, prompt, early examination and, if necessary, treatment by competent medical men will lessen the danger of adverse consequences amazingly.

But in avoiding infection and injury, one must not be careless regarding what is put in or near the eyes. This covers all preparations and cosmetics intended as an aid to beauty, as well as all patent medicines, lotions, ointments, washes, etc., put into the eyes in a foolish attempt at the self-remedy of some ailment (see *beautifying the eyes, eyewashes, patent medicines,* and *quackery and fraud*).

Not least among the cares in preserving eyesight is the avoidance of the over-use of certain drugs or over-indulgence in the enjoyment of alcohol and tobacco (see *drugs, drink,* and *tobacco*).

In substance, constant vigilance is the price of good eyesight. This is most necessary when the eyes are seemingly all right, for then one is likely to take them for granted and ignore them. And this vigilance is best expressed, once the habit of constantly protecting the eyes has been formed as outlined above, by regular, periodic examination of the eyes by an oculist (see *examining the eyes*). All persons should have such examination *at least* once every two years before the age of forty, and once each year after that age. Naturally, if any adverse symptoms develop (pain, headache, blurred vision, etc.) an examination should be had *at once,* regardless of how recently the last examination took place.

See also *baby's eyes* and *children's eyes.*

CATARACT. This is a disease condition of the eye in which the crystalline lens or its capsule becomes cloudy or

opaque so that, when it has gone far enough, it will not transmit sufficient light to the retina for vision and blindness ensues. Contrary to popular opinion, cataract is not a "growth" that forms over the eye, but a degenerative change that takes place *within* the lens itself. Broadly speaking, it is fundamentally the result of some interference with the nutrition of the lens, which interference may be brought about by any of, or combination of, a number of factors—age, disease, injury, diet deficiency, a focal infection (as of a tooth root, tonsil, etc.), or perhaps merely general ill health, to mention the most obvious. A cataract generally forms gradually, usually over a period of years, and may never form completely, in which case there will be only impaired vision and not blindness. Ordinarily the opacity will begin to form around the edges of the lens and grow inward, causing a narrowing of the field of vision, but sometimes opaque spots will form near the center of the lens. The two main classes of cataract are senile cataract, that coming on in advanced age, and that due to injury, infection, or the like, of the eyeball, which may happen at any time during life. Many treatments have been devised for cataract (drugs, electricity, x-ray, vitamins, etc.) but to date none has met with any notable success. The *only* satisfactory remedy is surgery. For this one must wait until the cataract is completely formed (or "ripe") when, by a very delicate operation, the cloudy lens is removed entirely from the eye. This permits light once again to reach the retina, and the focal powers of the missing lens is replaced by suitably fitted glasses. Though very delicate, this operation succeeds in restoring serviceable sight in about 90% of cases, and though disagreeable is not especially painful. One risks only an eye from which he cannot see anyway. Naturally, any one contemplating this operation will consider only the most expert eye surgeons—and it must not be forgotten that there are many quacks in this field.

The best safeguards against cataract, at any time of life, is to maintain a high level of general health, eat a properly balanced diet, protect the eyes from injury, infection, disease, and eye strain, and have any injuries or diseases that may afflict the eyes *promptly* treated by a trained oculist.

Cataract must not be confused with corneal opacity (see *cornea).*

See also *diseases of the eye.*

CAUSES OF EYE DEFECTS or IMPAIRED VISION. In general, the cause may be some congenital or inborn defect of the eye (see *heredity),* some error of refraction (see *refractive defects),* some affection of the eye (see *diseases of the eye),* or some physical damage done to the eye (see *injuries of the eye).* For more specific information, see under the ailment or defect in question.

CHALAZION. A small tumor or cyst formed in the upper eyelid as a result of the blocking of one of the tiny glands there and the consequent retention of secretion. It grows slowly and may reach finally the size of a small pea. At times they disappear spontaneously, at other times they must be opened and drained by an oculist.

See also *eyelids.*

CHILDREN'S EYES, care of. Much of adult eye trouble and bad vision can be traced to the neglect, indifference, or ignorance of parents concerning their children's eyes during the early years of their life. Often proper attention at this time will readily rectify defects which if let go will result in serious sight impairment in later years, perhaps even in blindness. Various surveys demonstrate that approximately 15%-34% (in different surveys) of school children suffer from some degree of visual deficiency, and there appears to be a tendency for this to increase, possibly because of civilization's constantly augmenting demands on the eyes.

It is the responsibility of parents to do all in their power to preserve the eyesight of their children. This they must do by exercising all care in their power to protect the children's eyes, and by seeking all available scientific aid if anything appears to be wrong. There are a number of signs indicative of eye trouble (see under *symptoms)* which the alert parent will note and which will send him with the child at once to the oculist, or at least to the family physician.

Most eye defects in childhood are refractive. For these the usual remedy is glasses. However, in the case of children,

these may or may not be necessary. Small defects *may* be outgrown as the eyeball develops; young children are normally farsighted, but the natural evolution of the eye overcomes this as a rule. But it is a very grave mistake for parents to assume, as is all too much the rule, that children will outgrow all sight defects—tragic consequences have frequently attended this foolish notion. This is especially true of cross-eyes: since in a number of cases children recover spontaneously from this defect, too many parents assume complacently that all will do so, with the result that not only a troublesome but very unbecoming defect that might have been corrected in childhood with relative simplicity, becomes so stubbornly fixed that it is carried through life. And any notable degree of nearsightedness in a child so operates in the eye's efforts at accommodation that, if uncorrected, it may aggravate itself and perhaps end in damaging the retina and causing blindness. A fine testimonial to parental love and care! The *only* safe and sensible course is to take *all* cases of child eye trouble to the oculist and let him decide whether glasses or other treatment is necessary. And it should be made certain that the oculist is a properly trained and competent one, not some quack, for in childhood more than at any other time can wrong glasses do irreparable damage.

So much for the attention parents owe their children if they possess eye or sight defects. But their obligation is not there finished. In the child's daily life, at home and at play, in his work and in his amusements, parents must constantly exercise supervision and care in the interest of his eyesight. Some of the more outstanding features of this program follow:

At all times and in all connections must the child be kept from over-working or straining his eyes. In most localities, the worst offender in this respect is our present educational system with its over-emphasis on eye-work, and especially of young eyes not yet toughened or developed to meet such demands (see *school and sight).* Not only are the eyes abused during school hours, but usually the child is sent home with a ridiculous amount of homework which not only calls for additional eye effort, but must often be done under the added load of artificial light. Parents and Parent-Teacher organiza-

tions should do all in their power to combat this evil. Another grave error is committed in hastening the return to school of a child after illness. Sickness of any sort lessens the resistance and endurance of eyes even in adults (see *disease and sight),* and particularly so in children; nevertheless it is the custom to rush the child back to school, usually before he or his eyes are ready for it, so that he does not "fall behind his class" any farther; and then in addition he and his eyes are made to do extra work in a harmful attempt to "catch up." Much better to graduate a year later and retain one's eyesight.

But school is not the only source of juvenile eye strain. Children must not be encouraged to read too early or too much; indeed, they should be kept from so doing. And such reading as is done should be supervised so as to make certain it is done properly (see *reading).* All other close work should be likewise limited and supervised, as writing, drawing, sewing, etc. For all eye work done by the child, both close and distant, proper lighting should be provided (see *lighting).* Movies are permissible (see *movies),* but in moderation; many parents allow their children to see them too often merely to get them out of the house.

A constant source of danger to children's eyes is damage through accident or injury of one sort or another. Against this parents must ever be on their guard. Games or sports that carry this hazard should be forbidden, or else permitted only with suitable precautions, eye-guards, etc. All toys or instruments (as guns, bows and arrows, pea-shooters, sling-shots, toy swords, and sharp or pointed toys of all description) likely to injure the eyes should be kept out of children's hands or permitted only under supervision and after adequate instruction in their correct use. When injuries do occur, immediate medical attention is called for, not home remedies.

The diet of children should be watched to see that it is ample and properly balanced. Not only do certain elements of diet (as for example vitamin A) affect sight directly, but a correct diet is a requisite for good health, which in turn is necessary for good eyesight (see *diet).*

Children must get sufficient sleep, not only for their health's sake, but also that their eyes can develop as they should and that they may recover from the wear of the day.

Nor is it wise, as is so often done, to allow children to sleep in a room with a light shining on their faces. This tends to hinder the recovery and chemical replacement that must take place in the eye after the demands of the day.

Even if everything appears to be going along all right, a child's eyes ought to have a regular examination by an oculist, every six months to a year, just to be on the safe side and to be sure to catch any defect that may develop at its start when it may be corrected with a minimum of trouble, time, and expense.

See also *baby's eyes* and *care of the eyes.*

CHOOSING GLASSES. See *appearance and glasses, buying glasses, glasses,* and *lenses.*

CHOROID. This is the dark-brown, inner layer of the wall of the eyeball. Outside it is the sclera, the tough outer layer of the eyeball wall. Covering the inner surface of the choroid is the light-sensitive retina which it supports and nourishes.

See also *eye.*

CILIARY MUSCLE or BODY. See under *muscles of the eye.*

CINDER IN THE EYE. See *foreign bodies in the eye.*

Clean-omist. A patent tissue (put out by the Clean-omist Co., New York City) for polishing the lenses of glasses. It is put up in handy little packets that may be carried in the pocket or handbag. Not only does it polish the lenses, but it is also claimed that it is chemically treated so that when once polished with it, the lens will not cloud or mist (as from steam, coming from the cold into a warm room, etc.) for the rest of the day.

See also *care of glasses.*

CLOUDY LENS. A popular term for cataract, which see.

COLD IN THE EYE. A common term sometimes applied to the condition of "pink eye" or conjunctivitis, which see.

COLLYRIUM. A technical term for eyewash, which see.

COLOR BLINDNESS. This is simply the inability to see or distinguish colors, in particular the primary colors (red, yellow, and blue—other colors are combinations of these). Color blindness may be partial or complete; that is, a person may be unable to see only one color or he may not be able to distinguish any color at all. To a person with total color blindness all the world appears to be of different shades of gray, much like an ordinary photograph; to the others, only the color or colors to which they do not react seem gray. In this country, the greatest amount of color blindness is for green, with red second, which may help explain some of our many traffic accidents. This condition occurs more commonly in men than in women: estimates run all the way from 4 to as high as 10 out of a hundred men (probably nearer the former) and from 1 to 5 out of a hundred women thus afflicted; no accurate census of this has ever been taken. There are probably even more who are affected to a minor degree which only impairs fine color judgment or the ability to distinguish between slightly different shades of color.

Color blindness may be congenital, that is, a person may be born with it, or it may be acquired during the course of life. If congenital, vision is often as acute or sharp as normal; but when acquired, visual acuity is often also impaired. Acquired color blindness is commonly the consequence of some disease which causes changes in the retina, the nerves connecting it with the brain, or the color perception centers in the brain; the worst offenders are syphilis, acute typhoid, excess of alcohol or tobacco, etc. Recent experiments indicate that there may also be some psychological factors: persons were made temporarily color blind by suggestion given under hypnosis.

Save for the inconvenience and the occupational impediment it may offer in professions demanding color perception (as trainmen, signalmen, drivers in traffic, artists, etc.), this condition is not overly serious. Indeed, the majority of persons thus afflicted are unaware of it until tests demonstrate the fact. There are a number of these tests, ranging from the mosaic dot patterns in which numerals stand out to normal vision, through the Edridge-Green lantern with its many and variable color combinations, the colored bead boxes, the tufts

of colored yarn, to the lately evolved series of colored chips which, by a person's ability to match them, examine not only color blindness but degree of color judgment as well. These and other tests will quickly show the presence or absence of color blindness. They can be given by any well-equipped oculist, to whom one may apply if he suspects this trouble. There is no known cure for the disorder; those having it should simply avoid activities and occupations that require color perception. Color-blind persons should be wary of driving automobiles in traffic where the recognition of signal lights is important, though there are means of circumventing this to some extent (see *automobile driving*). Recently, there has been some encouraging results from treatment with vitamin A, but it is yet too early to be sure of its exact value.

Other defects of vision may occur in combination with color blindness, but these are amenable to the usual remedies (glasses, treatment, etc.) available for them.

COLORED GLASSES. See *sunglasses*.

COLOR OF THE EYES. What is commonly known as the color of the "eye" is really only the color of the iris portion of it. This color is due to the pigment cells present in the iris, different colors being the result of different amounts of pigment. This coloration protects the retina from an excess of light that might otherwise come through the iris. In albinos, in which this pigment is absent (the iris then appearing pink from the underlying blood vessels) the eyes are very intolerant of bright light. At birth most eyes are bluish, a color for which only a moderate amount of pigment is present; permanent coloration starts after about six weeks; thus it may be seen why the eyes of babies should be protected from strong light. Blue eyes have somehow come to be considered most beautiful and attractive, especially in women, but a poll of a number of men showed that actually 65% of them preferred green eyes while blue eyes got the vote of only 20% of them. Blue eyes seem to be getting more scarce, the result of blue eyes being what is known in heredity as a recessive characteristic, which means that if only one parent is blue-eyed only one out of four children will have blue eyes. It is commonly considered that the two eyes of a person almost

invariably are the same color, which makes it rather surprising when statistics reveal that about 8% of white people have eyes whose colors do not match. There are also a number of interesting beliefs and superstitions whereby the color of the eyes are supposed to indicate traits of character.

CONES of the retina. These are one of the two types of light-sensitive nerve endings that are scattered over the surface of the retina and make it possible for it to transmit visual impulses to the brain. The other type is rods (which see). There are about 7,000,000 cones in the retina of each eye. They are so called because their shape resembles that of a cone. The cones react to colors, whereas the rods register only black and white contrasts. Cones predominate in the central area of the retina *(macula lutea)* and are exclusively present in the small central portion *(fovea centralis)* devoted to acute, detailed vision, growing less as one moves outward.

See also *retina* and *sight.*

CONJUNCTIVA. This is a delicate, transparent membrane which covers the exposed surface of the eyeball, including the portions under the upper and lower eyelids, and then turns back to line the inner surfaces of these eyelids. Thus, in blinking, one part of the conjunctiva slides over another portion, for which purpose it furnishes smooth surfaces, kept lubricated by tears from the tear glands, as well as sealing in and protecting the eyeball. Exposed as it is, it is subject to a number of irritations that may produce inflammation, known as conjunctivitis, which see. See also *eye.*

CONJUNCTIVITIS. An inflammation of the conjunctiva (which see). Though this condition may originate from a great many causes, they all fall into two main classes: infectious and non-infectious. The former is due to infection of the membrane by bacteria of some sort and the resultant inflammation may vary from mild to violent, depending on the nature of the organism causing it, and is usually accompanied by some degree of discharge which may run from a thick, yellowish, purulent one (sticking the eyelids together mornings, etc.) to a thin, milky, mucous flow. Non-infectious con-

junctivitis follows from some irritation to the eye, as from dust or grit in the eyes, whipping of wind, action of smoke or fumes, exposure to excessive heat or light, etc., and is often associated with watering of the eyes. Uncorrected eye strain is also a frequent cause, especially aggravated by reading in a bad posture, poor light, in moving, jolting vehicles, or the like. General poor health also predisposes to it.

Cure is fundamentally a matter of removing the cause. If due to bacteria, a physician must be consulted for suitable treatment and medication—never use patent medicines or "drops" for this. If it is the result of irritation, protection from the irritating agent must be supplied in the form of goggles, tinted glasses, etc. If eye strain is the cause, the fitting of proper glasses is indicated. If improper reading habits are to blame, they must be corrected, adequate lighting provided, and perhaps the eyes given more rest. If this condition persists too long or recurs too often, an oculist should be consulted, for it may indicate some grave condition requiring correction or treatment.

For simple cases of inflammation, some relief may be obtained by laying hot, moist packs on the eyes for five minutes at a time. Or the eyes may be bathed by a solution of witch-hazel, normal saline, or boric acid. But this is the positive limit of home treatment, for anything further requires the services of a doctor.

Be careful when around persons suffering from a conjunctivitis, especially when there is a notable discharge, for if it is the infectious type the discharge will carry the bacteria which may be transferred by carelessness with towels, napkins, fingers, etc.

Certain forms of acute infectious conjunctivitis are known as "pink eye."

See also *diseases of the eye.*

CONSERVATION OF SIGHT. This designation has been given to the concerted and consistent effort which has sprung up in recent years, and is continuing to grow, on the part of municipal, state, federal, and other organizations to preserve the nation's eyesight, to halt as much as possible any increase

in eye deficiencies, to encourage the proper care of normal eyes so that they remain so, and to do whatever is feasible to remedy or correct eye and sight impairment.

Naturally, the biggest feature of this work is educational, making the general public "eye conscious" so that they will realize the importance of their eyes and the necessity for taking adequate care and precaution with them. Next comes the supplying of accurate, understandable information to make these efforts intelligent and effective; and finally the furnishing of centers, clinics, etc., where reliable examination and any required medical aid, glasses, or the like may be obtained at moderate cost, or if necessary gratis, by persons who cannot afford attention through the usual channels of oculist and optician. Inquiries to one's local Board of Health will determine what facilities of this sort are available in one's community, and under *books* in this volume are listed several associations that will furnish information on the subject.

But the conservation of sight is and will always be a work broader than can be handled completely by any organization: it is ultimately a question of each person's constant and unremittent care and protection of his own eyes and, so far as is possible, those of others about him. Information can be furnished, but the effort must come from the individual. This work starts at the moment of birth when parents must make certain that their children's eyes are getting all needed attention (see *baby's eyes),* continues through childhood (see *children's eyes),* and is finally passed on to the child himself when he becomes old enough. And every day each person should be conscious of what is due his eyes, giving them all the little considerations that mean so much in preserving them (see *care of the eyes),* protecting them from accidental damage (see *injuries of the eyes),* from infection and affection of all kinds (see *diseases of the eye),* using them properly when close work is demanded (see *reading* and *writing)* and then only when ample and correct illumination is supplied (see *lighting),* avoiding things harmful to sight (see *drugs, drink,* and *tobacco),* keeping oneself in the best possible bodily condition through correct food (see *diet)* and healthful habits and avoidance of sickness (see *disease and sight)* since the eyes reflect the state of the body, and by regularly having the eyes examined

by an oculist (once a year or so), even though nothing appears to be wrong, in order that any trouble may be caught in its early stages before it can do serious damage (see *examining the eyes).* Naturally, any outright indications of eye trouble (see *symptoms)* should send one scurrying at once to the oculist, regardless of how recently one may have been there. And if trouble does develop in the eyes, such remedial measures as advised by the oculist should be taken without delay, whether they be in the form of medicine, surgery, glasses, or exercises (see *remedy of defective sight).*

CONTACT LENSES. These, in their improved form, are the most recent and radical development in glasses for correcting refractive defects of the eyes. Though they were first suggested in 1827 by the English astronomer Herschel, and in 1880 a German optician, Mueller, succeeded in making some specimens in blown glass, it was not until recent years that technical advances in the grinding of lenses have made possible the turning out of satisfactory examples.

The contact lens is simply a thin piece of glass so curved as to fit directly upon the exposed portion of the eyeball (including that under the upper and lower eyelids), and so ground as to offer optical correction for any errors of refraction present in the eye. The most obvious advantage is to appearance, making unsightly spectacles unnecessary, and to this end they are worn by a number of well-known stage and movie actors, public men, etc. They are also of practical aid in professions where such things as spray (as with ships' officers) or mist might cloud spectacles. Moreover, they lend a certain amount of protection against dust and fumes. Lately they may be had in special glass to filter out excessive heat or light rays. It is estimated that about 6,000 persons in this country wear them, whereas in Germany, the country of their origin, the number may run to 50,000.

While covering most of the exposed eyeball, it is only the small center portion of the contact lens that is ground for optical correction; the rest merely holds this portion in place and is made to fit the contour of the eyeball as closely as possible to avoid irritation. Getting this fit accurately is one of the chief difficulties with this lens, though some recent devel-

opments, as a means of taking a cast of the eyeball, has made this somewhat simpler. The glass around the central refracting portion may be left clear or may be colored white to simulate the eyeball.

Though vastly improved, the contact lens still has its disadvantages. First, they cost about $75-100 a pair. Then, they are not satisfactory for correcting astigmatism of the crystalline lens or for muscular imbalance or squint. Also, many persons, especially of nervous tendencies, cannot tolerate them in their eyes, and while reports indicate that about 80% of wearers get accustomed to them, there are many who never do so wholly. And in all cases one must get used to them slowly, wearing them at first only a few minutes and gradually increasing the time. Doctors recommend that they be not worn for more than four hours at a time, though one person wore them 16 hours a day for five years without ill effect, and in some instances they have stayed in the eyes as long as 36 hours. The common feeling that they offer a danger in breakage in the eye is groundless, for to date there is not a single report of such a happening, though many have sustained blows in the eye while wearing them. Any blow sufficient to break this lens, supported as it is by its fit to the eyeball, would almost certainly blind the eye anyway. And even this remote danger will be lessened as the new plastic lenses are perfected.

The contact lens is placed in the eye by means of a small rubber bulb (much like that of a medicine-dropper) upon which it is held by suction, the hollow of the lens is filled with saline or salt solution (made to match the composition of the person's own tear secretion), the face is bowed over this, the edge of the lens slipped under the raised lower eyelid, then under the upper eyelid, the bulb removed by a little squeeze, and a few blinks settles the lens in place. Thus a thin film of saline keeps the lens from actual contact with the eyeball, while the suction of its perfect fit holds it in place. To remove the lens, the bulb is placed once more on its center to hold it and the above procedure reversed. Of course, meticulous cleanliness of hands, bulb, and lens is required at all times.

The contact lens is also utilized in certain disorders—dis-

eases of the eyelids, softening of the cornea, etc.—to prevent the contact and rubbing of the lids against the eye.

An excellent technical work on the subject is *Contact Lenses* by T. E. Obrig, New York, 1942.

See also *glasses* and *lenses.*

CONVERGENCE. It is by the converging or pointing inward of the lines of vision of the two eyes so that both are directed at the same object, or the same portion of a large object, in order that the image of each falls on comparable portions of the retinas, generally the macula lutea, that a single visual impression of the object is obtained in the brain. If this does not take place, a different image is perceived by each eye and double vision results. The closer one is to the object, the more must be the convergence to achieve single vision. Convergence operates with the accommodation or adjusting of each eye to variations of distance from the object and intensities of light (see *accommodation)* to produce a single and clear visual impression of the thing looked at. Convergence is the result of the moving inward or outward, as the need is, of the two eyeballs, which movement is caused by the six muscles surrounding each eyeball (see *muscles of the eye).* The converging of two lines of vision from the eyes gives what is known as the binocular effect (see under *sight)* which enables one to perceive or judge distance or depth. If the eyes are not capable, through muscular imbalance, of converging correctly they may often be rectified by the fitting of suitable prismatic glasses.

See also *cross-eyes* and *sight.*

CORNEA. This is the central transparent portion or "window" of the eyeball through which the light rays pass to go on through the pupil and crystalline lens to be focused on the retina to produce vision. It is part of and continuous with the sclera or outer layer of the wall of the eyeball, which all about it forms the "white" of the eye. It bulges out from the eyeball so that the lens lies behind it as if in a bay window, so to speak, and is thus capable of a wide range of vision. The space between the cornea and lens is called the anterior chamber and is filled with a watery fluid known as the aqueous humor. The cornea not only serves to protect

the delicate inner structures while admitting light, but also through its curved surface (which normally is spherical) makes part of the refracting system of the eye. It is defects or irregularities in the curvature of the cornea that is in most cases the cause of astigmatism (which see). Though ordinarily quite resistant to infection, the cornea is subject to several disorders, in particular inflammation and ulcer, which if unattended may have serious consequences, ending perhaps in blindness. Injuries or neglected infections of the cornea may cause it to become opaque or cloudy so that vision becomes very dim or wholly cut off—a condition similar to, but different from, cataract (which see). There have been attempts at transplanting clear corneas to replace clouded ones, but though there has been some occasional success, the operation is still far more experimental than practical.

See also *eye* and *diseases of the eye.*

COSMETICS for the eyes. See under *beautifying the eyes.*

CROSS-EYES. In order to get a single, clear visual impression of an object looked at, it is necessary that both eyes point inward at it sufficiently so that each holds it in correct focus at the same time (see *convergence).* But in some instances the eyes turn inward too much, and again the result is double vision, just as it would be if they did not converge enough. This is the consequence of certain of the six extrinsic muscles surrounding the eyeball and controlling its movement either not acting with sufficient power (through paralysis, weakness, atrophy, etc.) or the opposing ones acting with too much power. While usually affecting only one of the eyes, it may at times be present in both, or in its most difficult form it may seize first one and then the other eye unpredictably (see *alternating squint).* This crossing of the eyes, or rather of their lines of vision, is known also as *squint,* or technically as *strabismus.* In some cases the eyes may turn outward instead of inward (called *wall-eyes),* but the fundamental causes are the same though merely in the opposite direction.

Squint is especially likely to be found in children. The power of using the eyes together and converging them is not present at birth; it must be learned and consequently is often

overdone. Cross-eyes may exist temporarily in children and disappear of its own accord, but the notion all too common among parents that children will always "grow out" of this is not only foolish but dangerous to the future eyesight of their offspring (see *children's eyes).* Ordinarily the rectifying of cross-eyes in children is a comparatively simple thing, and the earlier it is done the simpler it is; whereas if it is permitted to go on, vision in the weaker eye may become suppressed by the brain which ignores its visual impulses so as to escape the distress of double vision, sight is through one eye only, and after a time the power of vision may be lost entirely to the other eye.

Besides being due to muscular imbalance of the above sort, eyes may cross in later life as a result of disease of the eyes, injury to the head or eyes, or even failure to wear glasses for a refractive defect when they are necessary. It is estimated that a great many cross-eyes follow from uncorrected farsightedness, especially when complicated with astigmatism: the excessive effort of the eye muscles of the farsighted eye to focus on close objects brings about an over-convergence that results in a squint. This danger, of course, can be avoided by wearing proper glasses.

The remedy of cross-eyes varies according to the individual case. Glasses fitted with prismatic lenses (see *lenses)* will rectify the double vision while worn, but will not in all cases straighten the eye. At times, part of the treatment is occluding or covering the good eye so as to force the other to work and thus retain its power of vision, and through use train the negligent eye muscles to their task. At times when the crossing is due merely to muscular imbalance, the exercising of these muscles by means of certain instruments may strengthen, train, and restore them to their correct function (see *orthoptics).* These methods work best when they are applied early; if the condition is allowed to persist for years, the eye muscles may become permanently altered and so not amenable to such treatment. When this has taken place (as it also may as a result of injury, etc.) it may be necessary to have recourse to surgery to effect a cure, by means of which certain of the eye muscles are shortened or lengthened as required to swing the eye into correct position. While surgery

records many successes in this, it is not to be considered save as a last resort and upon the advice of an expert oculist. Not infrequently the mark is over-shot, a muscle is made too long or short, the eye is turned in the opposite direction, and a second, or even third, operation may be needed for correct adjustment. Even after a successful operation, orthoptic exercise is often required to re-establish coördinated muscular function.

Dr. J. F. Neumueller, of the American Optical Company, has recently perfected an instrument that can indicate in less than a minute the probability of a cross-eyed person's being cured of his affliction. It utilizes the phenomenon of the after image (which see). The instrument is simply a glass tube containing an electric wire that can be made to glow. This tube is placed horizontally before the person to be tested, the wire is set glowing, and the person stares at a red dot on the center of the tube with one eye only for a moment. Then the tube is placed vertically and the person stares at the dot with the other eye only. The tube is turned off and the person looks at a light-colored wall with both eyes. After a moment two dark lines appear to him, one horizontal and the other vertical (the negative after images of the glowing wire). If these lines intersect each other anywhere, the chances of correcting the cross-eyes are good; if not, they are remote.

CROWN GLASS. This is a type of glass broadly characterized as "window glass." Chemically it may be designated as a lime-silicate glass, or in more refined varieties as a boro-silicate glass. It is this latter type that is used for the bulk of spectacle lenses. Naturally, for this purpose it is made much more carefully and of more select materials than is ordinarily the case. The other important type of glass used in spectacles is flint glass (which see). This is much more expensive than crown, but is often used despite this fact in order to get the advantage of its higher index of refraction.

See also *lenses* and *glasses.*

CRYSTALLINE LENS. See *lens of the eye.*

CURE OF DEFECTIVE SIGHT or VISION. See *remedy of defective sight.*

CYCLITIS. Inflammation of the ciliary body or muscle around the lens of the eye (see *muscles of the eye* and *eye).* This condition must have prompt, expert medical attention as its neglect may cause serious permanent damage to the eye. See also *diseases of the eye.*

CYCLOPLEGICS. A general term for the group of drugs which when put into the eye cause temporary paralysis and relaxation of the muscles of accommodation and dilation of the pupil. These are often used by oculists in examining eyes in order to facilitate the examination and to be able to inspect the eye when it is at rest.

See also *examining the eyes* and *"drops" for the eyes.*

DACRYOCYSTITIS. Inflammation of the tear sac. The little duct that leads from this to the inner corner of the eye may become closed and the retained fluid will cause a swelling at the corner of the eye, along the side of the nose. If neglected, this may gather infection and form pus. Swelling at the inner corner of the eye should be promptly treated by a physician. See *tears.*

DALTONISM. Color blindness, which see.

DANGERS TO THE EYES. These consist mainly of physical damage that may be done the eyes through accidents, blows, flying particles, etc. (see *injuries to the eyes);* the effects of disease and infection of the eyes, especially if they be improperly treated (see *diseases of the eyes);* the subjection of the eyes to prolonged strain and fatigue (see *eye strain)* through the incorrect performance of close work (see *reading* and *writing),* in particular either without sufficient illumination (see *lighting)* or too bright and direct lighting (see *glare),* without giving the eyes enough relaxation (see *resting the eyes),* and by not giving defective eyes the help they need from suitable glasses (see *glasses)* or by failing to have new lenses fitted to the glasses when the old ones are no longer adequate; by neglecting the proper daily care and hygiene requisite for insuring the health of the eyes (see *care of the eyes);* and by subjecting the eyes to hazards in attempts at beauty, self-treatment with patent eye medicines, by patroniz-

ing quack eye "specialists," etc. (see *beautifying the eyes* and *quackery and fraud*).

See also *conservation of sight.*

DARK GLASSES. See *sunglasses.*

DAY BLINDNESS. A condition in which vision is better in a dim light than in full daylight. Certain defects of vision may cause this as may some forms of partial cataract in which the wider opening of the pupil in dim light would admit more total light (and give better vision) than would its smaller opening in bright light. It may also follow from opacities in the vitreous humor of the eyeball, tobacco poisoning, diseases of the retina, etc. Whatever its cause, its treatment is a matter for expert medical knowledge.

See also *night blindness.*

DAYLIGHT. See under *lighting.*

DEFECTIVE SIGHT or VISION. Poor eyesight is one of mankind's afflictions that civilization has not succeeded in stamping out or even lessening, as it has done with other disorders and diseases; on the contrary, civilization appears to be the cause of an alarming increase in defective vision. Few persons realize the magnitude of the problem. It is estimated, on the basis of numerous surveys, that about 23% of Americans have definitely subnormal vision at the age of 20, about 39% at 30, while at 40 almost half are affected. The percentages run even higher in groups subject to a good deal of close eye work: in elementary schools about 20% of the children are already suffering from some eye deficiency; this increases to about 40% among college students and goes up to about 50% of adults in industry. All told, it appears that about 70% of all Americans, or about 7 out of 10, have some defect of vision. About 80% of the applicants for the Air Service, which demands excellent eyesight, are rejected because of their vision, and these are young men. Granted that the requirements here are very stringent, yet it demonstrates that so-called "normal" eyesight is by no means as common as generally thought (see *normal sight*).

Or look at it from the standpoint of glasses. It is calculated

that about 60% of all city dwellers in America wear glasses, that 90% of Americans over 45 wears glasses all or part time, and that by the time they reach 70 the figure is 95%. And it must be remembered that by no means do all people who need glasses wear them.

Several things may be held accountable for this great amount of bad eyesight, but the fault seems to lie chiefly with civilization, the habits of life it imposes, and the great and augmenting demands it makes on the eyes, especially for close work. The eyes of man, like those of the higher animals, were formed by nature for distant vision almost exclusively. When looking at objects that are 20 feet or more away, the normal eye sees them with little or no effort, but when regarding things closer the eyes must accommodate to gain clear vision (see *accommodation)* and this calls for effort of the eye muscles the whole time close vision is being performed. The closer the vision the greater is the effort necessary, and modern man does the great majority of his work very close up, whether he keeps books, types, operates a machine, or the like, and even many of his amusements call for close vision. It is only to be expected that this great *excess* of close work and muscular effort, for which the eyes were never intended by nature, will result in strain, fatigue, and impairment of the eyes and consequently of sight, just as would be the case with any other overtaxed organ.

Naturally, though the largest single factor, the above is not the sole reason for bad sight. There are a number of other elements to the situation (hereditary defects, disease, diet, injury, etc.), but these are taken up elsewhere and the more immediate causes are discussed under each particular defect.

Sight defects may be divided into two main classes according to the nature of the treatment they require: those demanding medical or surgical aid, and those needing glasses. To the former belong all the many ailments, disorders, and diseases which may affect any one or several of the parts of the eye, or even the nerve connections with or in the brain, the proper coördination of all of which is necessary for good sight (see *diseases of the eye).* All of these call for prompt attention from an oculist, and the chances of recovery are increased with the absence of delay in getting it.

But the great majority of vision impairment cases is based in the optical or refractive portion of the eye (in particular, the lens and cornea), where some defect or malformation interferes with clear or correct focus on the retina, or in the improper shape of the eyeball as a whole (being either too long or too short), which places the retina either too far away from or too close to the lens to obtain the clear image on it requisite for normal sight. These errors of refraction are three: nearsightedness, farsightedness, and astigmatism (which see).

Defective vision may also follow from the improper functioning and coördination (from a number of causes) of the muscles controlling and moving the eyeballs, preventing both to point at the same spot in the field of vision. When there is an imbalance among these muscles the eyes cross (or turn out) and double vision ensues (see *cross-eyes).* This condition may be amenable to treatment by glasses, exercise, or surgery, depending upon circumstances.

Other factors may participate in causing subnormal vision (see *diet, vitamins, glands, age and sight, emotion, pregnancy),* but they all operate so as to fall under one of the above broad classifications.

See also *eye, sight, symptoms of defective sight, testing the eyes,* and *remedy of defective sight.*

DEFECTIVE SIGHT, SYMPTOMS OF. See *symptoms of defective sight.*

DEPTH PERCEPTION. See "binocular effect" under *sight.*

DIET and sight. There are growing indications of the importance of correct and balanced food intake in the maintenance of good eyesight, as indeed is the case with all body functions. Sight is not a thing in itself apart from the rest of the body, but perhaps even more than most functions reflects the condition of health of the body as a whole (see *disease and sight);* therefore, since proper diet is so extremely vital in the preservation of the health of the entire system, its relation to vision is obvious. Its most direct connection appears to be in the supplying of ample amounts of vitamins (and especially vitamin A), deficiencies in which will soon bring about sight impairments that in many cases even glasses

will not wholly correct (see *vitamins*); but the proper balance of all the vitamins, along with adequate amounts of the necessary minerals and protein appears also to have a definite, if somewhat more remote, bearing on the situation. Knowledge of the relations between diet and sight is as yet somewhat vague as to particular information, but investigation is constantly going on and the day may come when we can do much for ailing eyes at table. Already experiments have shown that cataract may be produced in animals by regulation of their diet; further experiments may do much to provide relief for this scourge of aged eyesight. Meanwhile, the best we can at present do in this respect is to take pains to insure getting an ample, nutritious, and balanced diet, with special regard to sufficient vitamins A and D. Space does not permit the calculation of a balanced diet here, but the whole subject is treated adequately for average needs, along with all figures and tables of food values required in drawing up diets, in *The Complete Weight Reducer,* by C. J. Gerling, published by Harvest House, New York.

The effect of diet on sight begins even before birth, through the food eaten by the mother during pregnancy. Careful selection of food by her during this period will do much to help her child start life with the best eyes possible (see *prenatal care*).

Di-Lash. A condemned, dangerous eyelash dye containing aniline dye and hence much too hazardous to be employed anywhere near the eyes, as injury or even blindness may be the consequence.

See *beautifying the eyes* and *quackery and fraud.*

DIOPTER. A unit of measure of the optical power of a lens. A lens with a focal length (the distance from the lens at which the lens focuses a clear image from parallel light rays—in practice, those coming from more than 20 feet) of one meter is said to have a power of one diopter. Since the more powerful the lens, the shorter its focal length, its power in diopters will be the reciprocal of that length in reference to the standard of one meter. Thus, a lens with a focal length of ½ meter will have a power of 2 diopters; of ¼ meter, 4 diopters; of 2 meters, ½ diopter, etc. When the measure

applies to a convex lens, the units are called *plus;* when applied to a concave lens, *minus.* It is in terms of diopters that the oculist writes the prescription for one's glasses (along with other information) so that the optician may grind them correctly. See also *lenses.*

DIPLOPIA. Double vision, which see.

DISEASE AND SIGHT. It has become a commonplace among medical men to refer to the eye as the "barometer" of the body, for not only does it reflect the presence or absence of general bodily health but it also often reveals some of the earliest symptoms of certain diseases, that is diseases of organs of the body other than the eyes themselves, and thus permit their prompt and effective treatment. The clear, bright eye of health and the dull, bloodshot eye of illness is apparent even to the casual observer; how much more, then, will they tell the trained oculist upon careful and thorough examination. By means of the ophthalmoscope he is able to look inside the eyeball and there see living nerves and blood vessels actually functioning in place (the only place in the whole body where this may be done) and from their condition derive indications helpful in the early diagnosis of disease, both of the eye and of the body. This constitutes an excellent reason against going to a mere optometrist for an eye examination: though he may measure quite competently the refractive defects of the eye so far as glasses will correct them, he is not fitted either by training, equipment, or his license to make the thorough and revealing examination referred to above. The optometrist's business is simply to sell glasses, whereas there are many disorders and toxic conditions of the system which produce blurred or dim vision as one of the *symptoms* of the disorder; under these circumstances glasses are generally not indicated at all, but rather the prompt and effective treatment of the underlying disease, upon which the sight defects caused by it will usually clear up.

It is doubtful that there is any sickness that does not weaken the eyes to some extent while it is in progress, but a number of them have a very notable effect. Venereal diseases, particularly in their later stages, often work serious damage to the eyes (see *syphilis* and *gonorrhea).* Fevers in general tend to

dim vision, possibly because fevers use up the vitamin reserve of the body at a greater rate than normal, and vitamin deficiency is a known source of vision impairment. Certain childhood ills (especially measles) weaken the eyes and their muscles and any eye strain suffered at this time may do permanent harm. Focal infections of various sorts—from infected teeth, tonsils, sinuses, neck of the womb, prostate gland, gall bladder, etc.—which continuously pour their poisons into the system will frequently affect the sight. There may be similar results from auto-intoxication produced by chronic constipation, general poor health failing to let the system cleanse itself of poisons, etc. Diabetes, kidney disease, arteriosclerosis, and such disturbances may cause changes in the retina. Brain conditions affecting the nerves and centers of sight may follow from tumors, syphilis, sinus infections, chronic poisoning from lead, wood alcohol, tobacco, etc. Muscular imbalance of the eyes (leading to double vision) may often be traced to inflammation or injury of the nerves supplying the eye muscles, to advanced syphilis, brain tumors, infection of the nasal sinuses or of the ear, diphtheria, diabetes, etc. Opacity of the cornea may frequently be the consequence of (besides injuries, burns, etc.) gonorrheal infection (especially in the case of infants), tuberculosis, smallpox (when inadequate care has allowed the formation of pox on the cornea), and the like. These are some of the more noteworthy of the illnesses having effects on sight; there are many others of lesser importance.

About all one can do to counteract these dangers is to strive constantly and intelligently to keep oneself in the best possible health, to do all possible to avoid contracting any sickness or infection, and when in spite of all precautions some disease is contracted, to have it *promptly* treated by a competent physician so as to recover as quickly as can be managed before there is any permanent ill consequence to the eyes.

Not least important in the matter of disease and sight is the consideration shown eyes during illness. The muscles of the eyes are temporarily weakened by any prolonged, confining illness, just as are those of the arms or legs. Consequently, they should during this time be spared as much effort and exertion as possible. But in most instances just the

opposite is true. In the attempt to offset the boredom of long hours in bed or a chair, most invalids read, write, embroider, or do other close and eye-trying work excessively; the result is that the eyes get even more use than normally just when they are poorest fitted to endure it. The eyes must be consistently spared, during convalescence as well as during sickness, if one wishes to preserve his sight at its best.

The above has been concerned with diseases of the body as a whole having an indirect bearing on the eyes. There are also numerous affections and disorders that attack the eyes themselves, with adverse effects on eyesight (see *diseases of the eye*).

DISEASES OF THE EYE. The eye is a highly complex bit of mechanism made up of refracting bodies, nerves, and muscles, held in position by a delicate structure of membranes, and nourished by fluids and a system of tiny vessels (see *eye*). Good sight depends upon the correct functioning of each and every part and upon the coördination of all the parts as a whole. It may thus be seen how many are the opportunities for disorder, since interference with the function of any part of the eye will interfere with sight. The two main sources of such interference are accidental physical damage to some of the eye structures (see *injuries to the eye*), and disease or infection of them.

Sicknesses affecting the body as a whole frequently have a definitely adverse influence on vision (see *disease and sight*), but more immediate is the consequence of those disorders striking directly at the eye itself. Working as they do upon the very structures of the eye, neglect or improper attention is quite likely to allow them to make some permanent change in these structures and result in a lasting impairment of eyesight, and in some circumstances even in blindness. On the other hand, with relatively few exceptions these eye diseases will yield to *prompt* and proper medical treatment with little or no loss of vision. The earlier they are attended, the better by far are the chances of recovery; so the wise person will waste no time in visiting his physician or oculist *(not* an optometrist) at the first persistent indication of trouble—pain in the eyes, redness or inflammation, feeling of tightness or

pressure in the eyes, blurred vision, etc. Of all things that should *not* be treated with home remedies, these eye diseases come very near to heading the list. Expert advice should be sought without delay and conscientiously followed.

Each part of the eye (as the cornea, retina, lens, iris, nerves, conjunctiva, eyelids, etc.) is subject to its own peculiar disorders which are taken up under the discussion of each of these parts. Among the more important and serious of the eye diseases are: glaucoma, trachoma, and cataract (see each), but all disorders and affections of the eye are to be treated with the greatest respect.

See also *care of the eyes* and *defective sight.*

DISTANCE PERCEPTION. See "binocular effect" under *sight.*

DOUBLE VISION. The great majority of cases of double vision is due to muscular imbalance of the muscles of the eyeballs. This prevents them from moving in coördination and pointing at the same spot in the field of vision (see *convergence).* Thus, the images in the two eyes do not fall on corresponding portions of the retina, normally the fovea centralis (which is necessary to get single vision), and double vision is the consequence, the eyes "crossing," or sometimes turning outward (for further details, see *cross-eyes).*

Double vision may also be produced temporarily by excessive indulgence in alcohol, the use of certain drugs, some forms of hysteria, etc., which cause the eye muscles to lose their power of coördination and each eye sees its own separate image. In rare instances, gross defects in the formation of the lens of the eye, or the presence of two or parts of two lenses in the eye, may give double vision in one eye.

DRINK and sight. The two main and best known effects of alcoholic over-indulgence on sight are double vision and blurred sight. This alcohol accomplishes by its temporary partial paralyzing influence on the muscles of the eyes, which influence may extend finally to all the muscles of the body if drinking is continued. The power of coördination of the eye muscles being lost, each eye sees separately and a double image is the result (see *double vision).* The focusing muscle

of the crystalline lens (the ciliary muscle) is likewise affected, the lens is not correctly focused to throw a clear image on the retina, and blurred vision ensues. Alcohol also interferes with one's general power of and will for concentration of the faculties, and this further aggravates the above condition. It is also held by some authorities that consistent excessive use of alcohol may tend to promote permanent partial blindness, especially if combined with a vitamin B deficiency.

DRIVING and sight. See *automobile driving.*

DROOPING EYELID. See *ptosis.*

"DROPS" for the eyes. These fall into three broad classes: the washes and lotions put into the eyes to flush them out or soothe them (see *eyewashes);* the medicines, either prescribed by a physician or the commercial products (see *medicines* and *patent medicines);* and the drugs known as *cycloplegics* (usually homatropine) which when placed in the eye cause temporary paralysis of the muscles of accommodation and dilation of the pupil so that the interior of the eyeball may be examined with greater ease and while the eye is at rest. Of whatever category, it is wise to put no drops into the eyes save as prescribed and ordered by a trained physician.

DRUGS and sight. In common with other organs of the body, the eyes will react to various drugs and agents in manners that will affect vision. Most persons who have had a complete eye examination are familiar with the temporary paralyzing effect on the muscles of accommodation of such drugs as homatropine, atropine, etc., which are in the "drops" the oculist places in the eyes (see *cycloplegics* and *examining the eyes).* These cause a definite blurring of vision and dilation of the pupil for several hours. Morphine and opium will do just the opposite and contract the pupil to mere pin-points. Arsenic in excess will affect the character of the nerve endings in the retina. A substance like dinitrophenol (present in many patent reducing medicines) will, if persistently used, lead to cataract. The list might be enlarged, but this will suffice to show that *nothing* is to be put into the eyes save under the advice of a physician or oculist.

DUST IN THE EYE. See *foreign bodies in the eye.*

Ear-ease. A patent device consisting of small, soft, pliant tubes to slip over the ear-hooks of spectacle temples to prevent rubbing and irritation. This will probably serve its purpose well enough, but correctly fitted frames should not rub and consequently should not require such protection. If a person's ears happen to be especially sensitive in this way, temples may be had with hooks sheathed in plastic which will prove more efficient as well as neater in appearance and easier to keep clean.

See also *Nos-ease* and *wearing glasses.*

ECCHYMOSIS. A technical term for a bruise or a black-and-blue spot, but sometimes used in special reference to a black eye, which see.

ECTROPION. A turning out of the edge of the eyelids. This may be a consequence of an attack of trachoma. It prevents the lids being properly closed and, if allowed to endure, may result in damage to the cornea. It is customarily rectified by surgery. See also *entropion.*

EDUCATION AND SIGHT. See *school and sight.*

EIKONIC LENSES. A new type of lens designed and ground to rectify any differences that may exist between the size and shape of the images seen by the two eyes, which differences would prevent obtaining a single clear image in the brain. These lenses will at the same time correct any of the usual refractive defects of vision.

See also *glasses* and *lenses.*

EMMETROPIA. A technical term for the normal condition of the eye so far as its refracting or focusing powers are concerned and when its sight is in consequence what it should be. See *normal sight.*

EMOTION AND SIGHT. Eyesight is commonly thought of as a thing in itself, good or bad according to the physical condition of the eyes. However, more and more is it being realized how intimately vision is linked with the state of the

whole body. Not only does sight respond to the condition of health or sickness of the entire system (see *disease and sight),* but it is also very much under the influence of one's psychological and emotional state. Anger, fear, grief, excitement, etc., may affect the eyes. The popular expression "blind with rage" is not without foundation in fact. Drs. E. I. Strongin, B. Korchin, and Mrs. N. Bull, of Columbia University conducted careful experiments to investigate this and found that of the persons tested the vision of 36% became better when emotionally aroused and of 22% it became worse. But perhaps more important is the fact that this influence is also exerted upon the coördination and binocular effect of the two eyes, and consequently upon the person's distance or depth judgment. It was found that of those tested 14%-22% had their distance judgment impaired under the stress of excitement, while only in 4% was it improved. This would have particular bearing upon persons driving cars under trying circumstances, aviators, etc. Investigations among soldiers show that a goodly percentage of cases of night blindness among them is not due to dietary deficiency at all (their diet being carefully balanced), but to psychological factors, especially fear, often induced by some terrible experience encountered in the course of fighting. An additional proof of the power of psychic factors upon sight was obtained in the experiments of Dr. Milton H. Erickson. Through suggestions given persons under hypnosis he was able to produce in them at will either complete blindness or color blindness for any or all colors. This state endured when the hypnosis was lifted, but further suggestion under a second hypnosis immediately restored normal vision.

Those interested may study this subject further in *Psychological Optics,* by Vernon W. Grant.

ENTROPION. A turning inward of the edge of the eyelid. The consequent rubbing of the eyeball by the lashes produces severe pain and irritation and, if allowed to continue, may cause serious damage to the eye. It is usually a result of trachoma, but is sometimes caused in old people by spasm of the eyelids. Some temporary relief may be obtained by having

the lashes pulled out (by a doctor, of course), but its permanent correction is through surgery. See also *ectropion.*

EPIPHORA. An abnormal tearing or watering of the eyes sufficient to cause overflowing down the cheeks. See *watering of the eyes.*

ERRORS OF REFRACTION. See *refractive defects.*

EXAMINING THE EYES. The complete examination of the eyes is made up of two chief parts: the refraction and the medical examination. The former consists of examining and testing the eyes for their optical properties and visual acuity and to determine (if they prove to be below normal) the nature of their refractive defect (nearsightedness, farsightedness, or astigmatism) and the type and power of glasses necessary to correct it (see *testing the eyes).* For this many people go to an optometrist and if this is all that is required an ethical, properly trained optometrist will suffice; but he is able only to fit one with glasses and is not trained or permitted to carry out the second or medical portion of the examination, which may be more important than the first. For it is in this portion of the examination that are discovered the symptoms of the numerous diseases and ailments that may attack the eyes (see *diseases of the eye),* and, unless determined early and promptly treated, cause serious damage to the eyes and sight, often even blindness. This medical portion of the examination may also reveal the beginning of many general bodily or constitutional maladies which show their first signs in the eyes, the discovery of which enables a physician to give early and consequently much more effective treatment. Such an examination requires a trained medical man, preferably an oculist; the optometrist cannot perform it, nor could he treat any disorders found by it since he is not licensed to practice medicine. The oculist, on the other hand, can also do the first portion of the examination to find if and what kind of glasses are needed; this part too he can perform better than the optometrist since in order to get the most reliable results the eye must be examined completely relaxed and devoid of all strain and effort of accommodation, to accomplish which

"drops" are placed in the eyes (see *cycloplegics);* this the optometrist cannot do simply because the law does not permit him to administer drugs of any sort. Many assert that these drops are not really necessary, but most authorities still agree that, despite certain disadvantages to the patient, they should be employed to obtain thoroughly dependable results. (See also *optometrist* and *oculist.)*

An examination to be good should be complete, and when concluded all remedial measures suggested by the oculist should be put into effect without delay—glasses should be obtained if needed (see *buying glasses)* and *worn;* and proper treatment of any disease condition revealed, either of the eyes or of the general system, should be instituted at once. Nor should one think that because an examination shows no disorder he is free from worry thereafter, for one may start after the examination was made. The only safeguard against this is to have examinations of the eyes at regular intervals (just as most persons do with their teeth) so that any affection can be discovered as early as possible. There should be a complete examination of the eyes *at least* every two years (preferably oftener) before one is forty, and at least once a year after that age. This will prove one of the best and cheapest guarantees of enduring good eyesight.

See also *care of the eyes.*

EXERCISES for the eyes. This has been one of the most controversial subjects in the field of the remedy of defective sight. The fact that in *some* instances of certain disorders of the eyes exercises can be of real help (which fact all oculists will admit) has eagerly been seized upon by quacks and perverted into a pseudo-system for the cure of *all* deficiencies of vision, with the result that eye exercises as a whole have fallen under a cloud.

Eye exercises, then, may be handily classified into the useless and the useful. The former may in themselves be harmful (as the advice to stare into a bright light, etc.), constitute a waste of time, effort, and money, and may be pernicious in delaying one from seeking competent scientific care. This matter is taken up in greater detail under *"Sight Without Glasses."* (See also *quackery and fraud.)*

The useful or effective exercises are those designed to train and strengthen the extrinsic muscles of the eyeballs so that they will function and coördinate properly to achieve the convergence (which see) necessary to good sight. They are most commonly employed in the treatment of cross-eyes (which see). That is to say, exercises may prove effective in the correction of sight defects originating *only* in the muscular imbalance of the eyes. The quacks, on the other hand, assert that their exercises will cure *all* vision impairments, not only of muscular incoördination, but of a refractive nature as well: nearsightedness, farsightedness, and even astigmatism! To any one with the slightest knowledge of how the eye operates, this is at once apparent as the sheerest nonsense; yet every year many people with these defects spend considerable money in vain attempts to escape the necessity of wearing glasses, which is the only effective remedy for their trouble. These useful eye exercises are discussed at further length under *orthoptics,* the technical term which describes them.

Some doctors, especially of the older school, occasionally recommend a few simple daily eye exercises, not as a cure for any particular existing eye trouble, but as a preventive measure and for toning up the eye muscles. These may be of advantage to persons doing long hours of close work, as clerks and desk-workers in general. A few are given below, but they should not be considered in any sense as a remedy for actual eye trouble, to enable one to dispense with the attentions of an oculist when needed, the necessity for regular eye examinations, or the consistent daily care and resting of the eyes (see *examining the eyes, care of the eyes,* and *resting the eyes).*

These exercises should not occupy more than a few minutes daily, and are best done in the morning upon awakening, after the eye muscles have been well relaxed and rested by sleep. Upon awakening, before getting out of bed, one may lie flat on his back with his face pointing at the ceiling and, holding the head perfectly motionless, move the eyes upward so as to see as far past the head of the bed as possible, then swing the eyes slowly downward so as to see as far past the foot of the bed as can be managed, all *without moving the head* in the slightest, the shifting of vision being done only

by the movement of the eyeballs in the head. Return the eyes to their central position and then do likewise by swinging the eyes from one extreme side position to the other. Continue this routine for one to three minutes, taking care not to try forcing the eyes far enough in any direction to produce a feeling of strain or tautness. This exercise may be varied by starting the eyes at the upward position, swinging them in a circular motion to one side, continuing it downward, then to the other side, and on to the starting position, keeping this up for one to two minutes. Then, sitting up, arrange that some small object, as a knob on a bedpost or chair-back, is about 20-24 inches from the eyes and approximately in line with another small object, on the far wall of the room or outside a window, at least 15-20 feet away, preferably even farther. First look directly at the close object for a few seconds, holding it in clear focus, then shift the gaze to the far object and hold it in clear focus for a few seconds, then back to the first, and so on for one to two minutes. It is not advisable to do this with the distant object in bright sunlight.

EXOPHTHALMOS. A condition in which the eyeballs protrude or bulge abnormally from their sockets. This may be merely a peculiarity of one's physical make-up, especially if present from early life, but it may also appear in previously normal eyes as a symptom of swelling, inflammation, tumor, or some injury of the orbit behind the eyeball, which is usually the case if only one of the eyes bulge. Certain varieties of goiter (enlargement of the thyroid gland) are accompanied by this condition. Naturally, should this symptom appear, a prompt visit to the oculist is in order.

EYE. As an optical instrument, the human eye has been both praised and condemned. Professor Helmholtz is said to have declared that should an optician sell him an optical device as carelessly made as the human eye, he would feel fully justified in returning it and demanding his money back. Professor F. Womack has stated that, "Of all the sense organs, the eye is the worst planned and has the most serious inherent defects." It is, of course, this all too universal imperfection of the eye that makes regular examination, medical attention,

the wearing of glasses, and constant daily care and precaution so necessary.

But though there are relatively very few so-called "normal" eyes (see *normal sight),* the eye remains an amazingly intricate mechanism of truly remarkable sensitivity. It is more responsive to light impressions than the finest photographic plate known. It has been estimated by Dr. Selig Hecht of Columbia University that the human eye will respond to only 5-14 quanta (a quantum being the tiniest, indivisible unit of radiant energy known) of light, a thing no photographic plate can equal. It will also see under extremes of light and shade that render the best of cameras practically useless. The human eye changes or accommodates automatically and almost instantly in focus for changes from very close to very distant vision and has a wider field of vision than that of any animal.

The eye is not a separate organ complete and functioning within itself, but is very much a part of the whole body, dependent upon it for nourishment and energy, and reacting to illness or poor health in it (see *disease and sight).* The eye begins in rather an immature form in babies and grows and develops with the rest of the body (see *age and sight).* Also the eye must coördinate properly with the rest of the visual apparatus (the muscles, the nerves to and within the brain, and the centers of sight impression there) to obtain good vision. And finally, all the various parts of the eyeball itself must be in good condition and work together properly if sight is to be normal. It may thus be seen that there are ample opportunities in this complex system for breakdowns and consequent sight defects.

The eyeball is set well back in a strong bony socket or orbit, which protects it from most injuries, in which it rests upon a cushion of fat and is surrounded by six muscles that control its movements within the socket. It is a spheroidal or ball-like body approximately one inch in diameter, the wall of which is a tough membrane known as the sclera which is seen where exposed as the "white of the eye." In the center of the exposed portion the sclera has a round transparent portion or "window," the *cornea,* which is continuous with it and set in much like a watch crystal and through which light is admitted to the interior of the eye. Inside the sclera is a

dark-colored lining, the *choroid,* made up largely of a multitude of tiny blood vessels which serve to nourish the eye and its structures. Lining the choroid is a very thin but highly complex system of nerves, the *retina,* which is sensitive to light and transmits to the brain impressions of the images cast upon it by the lens. The millions of nerves from this lining concentrate into one main "trunk," the *optic nerve,* which along with the blood vessels passes out of the rear of the eyeball and through a fissure left in the bony orbit for that purpose. Behind the transparent cornea is the *crystalline lens* which normally focuses the incoming light rays into a distinct, sharp image on the retina. This lens is of a clear, elastic material contained in a transparent capsule which is suspended from the choroid all around the opening left in it behind the cornea by tiny muscle fibers, the *ciliary muscle,* the action of which alters the amount of curvature of the lens, and hence its focal length, so that the eye can adapt or *accommodate* itself to seeing clearly at various distances. Hanging in front of the lens is a ring-like membrane, the *iris,* which is a continuation of the choroid and has a small circular opening in the center, the *pupil,* through which light is passed to the lens and thence is focused on the retina. The iris is supplied with muscle fibers controlled by nerves which react to the amount of light reaching the eye so that the pupil is made smaller for bright light and larger for dim light, thus protecting the retina from too intense light and insuring best possible vision under varying circumstances. The iris is supplied with pigment cells, variations in which give rise to differences in the so-called "color of the eye" (which see). The lens divides the interior of the eyeball into two compartments: a large one behind it, the "posterior chamber," which is filled with a clear, jelly-like substance, the *vitreous humor,* which serves to keep the eyeball in its proper shape and prevent it from collapsing; and the forward much smaller compartment between the lens and the cornea, the "anterior chamber," which is filled with a clear watery fluid, the *aqueous humor,* which is slowly but continuously being secreted and drained away by tiny glands, which drainage when interfered with may result in a building up of pressure of the fluid and lead to a dangerous condition known as glaucoma (which see).

The iris is immersed in the aqueous humor. Completely covering the exposed portion of the eyeball is a thin transparent membrane, the *conjunctiva,* which turns back upon itself and lines the inner surfaces of the eyelids. This membrane seals the eye against too ready infection and furnishes a smooth surface for the eyelids to slip over in the process of blinking, which slipping is further facilitated by lubrication with tears secreted by the *lachrymal glands,* which are situated above the outer corners of the eyes, away from the nose (see also *tears).* Over the eyeballs are the *eyelids,* of which there is an upper and a lower, which are closed to cover the eye both voluntarily and instinctively to protect it from bright light and injury and to cleanse it and keep it moistened with tear secretion.

For further details, see each of the italicized items. For the mechanism of the process of seeing, see *sight.* See also *defective sight* and *diseases of the eye.*

EYE ACCIDENTS or INJURIES. See *injuries to the eye.*

EYE BEAUTY. See *beautifying the eyes* and *appearance and glasses.*

EYEBROWS and EYELASHES. These growths of hair are designed primarily as protection for the eyes. The brows, with their underlying tissue, form a cushion at the upper margin of the socket that helps guard the eye against blows, and their projection ahead of the eyes helps to prevent perspiration and rain from running into the eyes. The lashes furnish a partial screen against too intense light shining directly into the eyes and also offer a shield against fine flying particles, dust, etc. Consequently, too extreme plucking or trimming of these growths will nullify much of their protection. Irregular brows may be straightened out a bit so as to have a neater shape and outline, but reducing them to "modern" thin lines is not advisable, either for the eyes or for beauty. Any attempt at using cosmetics on the brows or lashes, in particular dyes, must be attended with the greatest caution, and better not done at all, for blindness may follow getting some of them into the eyes (see *beautifying the eyes).* Preparations for growing long lashes are also to be avoided. Since none of them

can possibly succeed in their alleged purpose, they are a waste of time and money, and may turn out to be harmful.

The chief disorder of the eyelashes is being turned the wrong way, outward or inward. When they are turned too much inward they may rub the eyeball and cause a severe irritation which, if uncorrected, may lead to damage of the eye. The most effective remedy for this is to have the offending lashes plucked out or permanently removed by electrolysis; this should be done by a physician and not by a beauty operator or oneself, if danger of infection or injury is to be avoided. Occasionally, too, the brows may harbor lice which are very tiny and difficult to see and which burrow into the skin and produce an irritation which may extend to inflame the eyes. Constant cleanliness is the best preventive.

See also *diseases of the eye* and *eyelids.*

EYE CUP. This is a device for facilitating the application of washes and lotions to the eye. It is a small receptacle, usually of glass but also of metal or plastic, holding something less than a fluid ounce and having its edge so curved as to fit snugly about the eye. In use it is held filled with wash, the eye is placed over it, and it is held firmly against the eye while the head is thrown back and the eye is opened.

The advisability of its use has often been questioned, though some doctors still lean toward it. It is often maintained that an eye-dropper will serve the purpose better. Indeed, the advisability of eyewashes themselves, save as prescribed by a physician for some definite disorder, is in doubt (see *eyewashes).* However, if an eye cup is used it should be kept scrupulously clean and sterile by frequently boiling in water, preferably a few minutes before use. Never use one after another person without first boiling it well. Do likewise if it has fallen on the floor. Never leave it standing around with wash in it thinking to use it again later as it may become contaminated; clean it after use and fill it again with fresh wash later. And if the edge becomes chipped or roughened, discard the cup and get a new one; not only may this allow the wash to leak out and become messy, but it offers a source of irritation.

See also *care of the eyes.*

EYE DISEASES. See *diseases of the eye.*

EYE DOCTOR or PHYSICIAN. A common term for an ophthalmologist or oculist (which see). He is a graduate physician who has specialized in the care of the eyes and is competent to treat them medically and surgically as well as to measure them for and fit them with glasses. He is to be distinguished from the optometrist (which see) who is trained and licensed *only* to test the eyes for and fit them with glasses and cannot prescribe medicine for or do surgery to them, and from the optician whose business it is only to grind lenses and prepare glasses according to prescription. Sometimes optometrists are loosely called "eye doctors" by the public, but this usage of the term is entirely erroneous.

See also *examining the eyes* and *buying glasses.*

EYE DROPS. See *"drops" for the eyes.*

EYE EXAMINATION. See *examining the eyes* and *testing the eyes.*

EYE EXERCISES. See *exercises for the eyes.*

EYE FATIGUE. Using the eyes for close work calls for a definite muscular effort on the part of the muscles of the eyes (see *accommodation)* which if too long continued leads to fatigue in them, just as is true with any over-used muscle. This condition of strain may also be caused or aggravated by improper illumination (see *lighting* and *glare),* deficiencies of the eyes (see *defective sight),* incorrect glasses or their improper use (see *glasses* and *care of glasses),* bad working habits (see *reading* and *writing),* general poor health or sickness (see *disease and sight),* insufficient relaxing of the eyes (see *resting the eyes),* and other factors. The symptoms are usually headache, a tired, painful, or burning sensation of the eyes, a reddened, inflamed appearance, etc. Prevention of fatigue consists of avoiding or rectifying the conditions that cause it.

See also *eye strain* and *care of the eyes.*

Eye-Gene. A patent eye lotion claimed by its ads to "clear and soothe tired, reddened eyes." Fatigue and inflammation of the eyes may be caused by so many things beyond the power

of any lotion or wash to correct, that such an assertion is ridiculous on the face of it. If mere flushing of the eyes is desired, a simple solution of boric acid, normal saline, or best of all plain water is much to be preferred. If the eyes require any medication beyond this, it should be prescribed by a physician or oculist. See also *eyewashes* and *quackery and fraud.*

EYEGLASSES. This designation is sometimes reserved for frames without temples for the ears (as pince-nez, Oxfords, etc.) in distinction from those with the ear-hooks, or spectacles. In general, the reference is broader and applies to all glasses (see *glasses).* Occasionally the term may be used for an eye cup (which see).

EYELASHES. See *eyebrows and eyelashes.*

EYELIDS. These structures which cover the outer portion of the eyeballs are two in number for each eye: the upper and the lower. The upper lid has almost all the movement in covering and uncovering the eye; the lower one is practically stationary. The purpose of the lids is to protect the eye from too bright light, glare, dust, injury, etc., and to do this they close instinctively when the eyes sense the approach of anything painful or dangerous. They also, aided by the flushing from the tear secretion of the lachrymal glands, keep the eyeball wiped clean and moist by their intermittent blinking. The lids are lined with a thin, tough, smooth membrane, the *conjunctiva,* which turns back to cover the exposed portion of the eyeball also. Thus blinking is facilitated by this smooth membrane's slipping upon itself, lubricated by tears.

The eyelids are subject to a number of disorders of varying gravity. They may develop tumor or *chalazion,* inflammation of the edges or *blepharitis,* spasmodic and violent closure or *blepharospasm,* a turning inward of their edges or *entropion,* a turning outward of their edges or *ectropion,* small boils and abscesses or *styes,* a relaxing and drooping over the eye or *ptosis,* a growing or turning inward of the lashes or *trichiasis,* ulcers, and some other less frequent diseases. (For further information, see italicized items.) Granulation of the under surface of the lids may or may not be serious; it may

follow over-exposure to wind and sun and as such is generally of no special consequence, but when it is the result of trachoma (which see) it can be very grave. Puffy eyelids are often not the result of any eye trouble, but are frequently indicative of some general bodily disorder or poor health and a sign that a doctor's examination and advice should be sought. Twitching of the lids is usually a nervous symptom and requires psychological rather than medical treatment.

See also *eyes* and *care of the eyes.*

Eyelin. An old patent eye ointment supposed to "rejuvenate the eyes and sight." Naturally, no ointment even when carefully prescribed can accomplish this, so it would be utterly beyond the power of any general patent product. No medicine should ever be put into the eyes save as prescribed and directed by a physician or oculist. See *patent medicines* and *quackery and fraud.*

EYE LOTIONS. See *eyewashes.*

EYE MAKE-UP. See *beautifying the eyes.*

EYE MUSCLES. See *muscles of the eyes.*

EYES. See *eye.*

EYES, CARE OF. See *care of the eyes.*

EYES, DEFECTIVE. See *defective sight.*

EYESIGHT. See *sight.*

EYE STRAIN. The normal eye sees objects at a distance of about 20 feet or more (optical infinity) with very little effort, for at that distance the light rays coming from the object to the eye are practically parallel and the lens of the normal eye is able to focus such rays sharply on the retina when the ciliary muscle is relaxed. But to see anything closer than this the ciliary muscle within the eye must work to bulge the lens more and shorten its focus for the divergent rays that are then coming to the eye and the extra-ocular muscles around the eyeballs must function to turn the eyes inward so that both point inward at the object and a single vision of it is obtained

(see *accommodation* and *convergence).* The result is that all the while the eyes are seeing things closer than about 20 feet their muscles are under constant tension or strain, and the less the distance the greater is this strain until at reading distance it becomes considerable.

Now the normal eye can endure quite a bit of this effort before any fatigue or adverse effects are felt, chiefly because as soon as any distant vision is done, even for only an occasional moment, the eye muscles relax and become fit for further effort. But when conditions exist that put the eye muscles at *all* or almost all times under strain, ill consequences are inevitable. When refractive defects are present in the eyes (farsightedness, nearsightedness, and astigmatism, which see) they must strain constantly in the attempt to achieve clear vision, and then usually fail. If the error of refraction is small, the eyes may be able to compensate for it and get adequate vision, in which case visual acuity would be normal but the eyes would be under constant strain to maintain it. Such eyes when tested simply by a Snellen test chart would appear normal; hence the necessity of a complete examination by an oculist with "drops" to relax the eyes so they can be examined when not under strain (see *examining the eyes).* The remedy for this type of eye strain is, of course, correctly fitted glasses (see *glasses).* However, strain may result from other things also: working without enough or the proper kind of light (see *lighting),* reading under wrong circumstances, too fine print, etc. (see *reading),* and in general using the eyes too much, especially for close work, without sufficiently resting them (see *resting the eyes).* A fairly common source of eye strain is wrong glasses, either from being improperly fitted in the first place or from one's eyes having changed so that one's glasses are no longer adequate. Consequently, one should go only to a reputable oculist to be measured for glasses, and one should have them checked for correctness periodically.

The symptoms of eye strain are many, but by far the commonest is headache which may occur over the eyes, on top of the head, or even in the back of the head. There is often a sense of weariness and effort in the eyes, perhaps even dull pain, and a heaviness and tendency to close. There is often excessive blinking and a habit of "screwing up" the eyes.

There may be smarting and burning, the lids may become reddened, inflammation of the eyes or a conjunctivitis may set in, and there may be present the desire to rub the eyes frequently. Mistiness and blurring of vision, particularly after prolonged close work, sometimes takes place. There may also occur symptoms remote from the eyes: pain in the neck or stomach, nausea and vomiting, nervous twitching of the face, sleeplessness, and general lassitude and a "played-out" feeling. Eye strain may even produce false symptoms of various diseases, from stomach ulcers and gallstones to rheumatism. The condition is therefore one that should be corrected as promptly as possible, not only for the sake of the eyes and vision, but in the interest of one's general well-being as well. The cure consists of rectifying the cause or causes, and the most expedient manner of finding out what they are and how to correct them is to consult a properly trained oculist—guessing and home remedies have no place in this. Some temporary relief may at times be obtained from the tired, strained feeling in the eyes by alternate hot and cold applications on the eyes (just plain water on a clean cloth), but this is only a *relief* and not a remedy, for it does not get at the cause; the doctor still must be visited for a complete examination.

EYE TESTS. See *testing the eyes.*

EYE TROUBLE. See *defective sight, diseases of the eye, injuries to the eye,* and under the ailment or defect in question.

EYEWASHES. In general, the people of this country are subject to over-medication, particularly of the self-administered patent remedy sort. To this the eyes are no exception, and many persons regularly flush their eyes with patent lotions and washes (Murine, Eye-Gene, i-bath, etc.) unnecessarily. For there is no need to wash out healthy eyes as a daily routine or precautionary measure. Nature takes care of this amply and excellently with the tear secretion that flows automatically as occasion demands. Should the eyes become infected, diseased, or otherwise affected, commercial preparations should not be employed for remedy, but *only* such medicines or washes as prescribed by a competent physician or oculist. And when the trouble has passed, any of the wash that remains should be

thrown out and not kept for some future occasion for which it may be totally unsuited.

Should it become desirable to wash the eyes merely to refresh them, remove dust, or the like, plain tap water (preferably boiled and allowed to cool) is as good as anything and better than most things. Conditions that require more than this will also require a doctor who can prescribe what is needed. Boric acid solution has long been considered a standard routine eyewash, but while it will commonly prove harmless enough, there are circumstances under which it may not be advisable (see *boric acid).* Probably superior for general use is normal saline or salt solution (see *normal saline solution).* There has also been some recommendation for home use of a solution of one teaspoonful each of baking soda and table salt (not iodized) in a quart of boiled water. But the safest course is to consult a doctor when anything more than plain water is required.

See also *"drops" for the eyes, eye cup, beautifying the eyes,* and *quackery and fraud.*

Ey-Tec. A condemned, dangerous eyelash dye containing as its coloring agent a silver salt which, if got into the eyes, may produce serious consequences. See *beautifying the eyes.*

FAKE EYE CURES, REMEDIES. See *quackery and fraud.*

FARSIGHTEDNESS. In this refractive defect of the eye, known technically as hyperopia or hypermetropia, the eyeball is shorter (in the distance from the lens to the retina) than normal and the lens is unable to focus the parallel rays of light coming from distant objects upon the retina, the focus lying behind the retina, and sight is consequently blurred and imperfect. Since in close vision the rays of light are divergent from the object to the eye, the imperfection of sight would then be even greater and nothing but large print can be read at ordinary reading distance. Under these circumstances vision is a good deal better for far objects than for near, hence the popular designation "farsightedness." This does not mean, however, that far vision is normal. If the defect is small, the eye may be able to accommodate sufficiently to see at a distance with normal clarity, but in so

doing the eye is always under an effort or strain, just as it is in close vision, and the person is constantly subject to the resultant ill effects (see *eye strain*). If the defect is larger, clear vision is impossible for both far and near objects. To get good vision and relieve the strain glasses are necessary.

This defect, the result of a malformation of the eyeball (not of the lens), is usually congenital, the result simply of a person's "being born" that way, or an arrestment in the development and growth of the eyeball (see *age and sight*). There is also another type of farsightedness that comes on with age, in consequence of the lessened elasticity of the eye lens and its muscle, making it impossible to accommodate sufficiently to get clear focus. In this the eyeball may be of proper length, but the aged and stiffened eye lens cannot bulge enough to strike a clear focus on the retina. But in both cases the result is the same: vision is imperfect for both near and far objects, but better for the far. Naturally, in its early stages trouble is first noted as a rule only on close vision (as in reading newspapers or other fine print) while distant sight remains fairly clear. This old age farsightedness is known as *presbyopia* (which see).

The remedy is the same as for any refractive defect of the eyes: glasses. By putting a proper convex lens before the eye the incoming light rays are converged sufficiently to bring the rest of the focusing necessary for clear vision within the power of accommodation of the eye; the extra lens gives the eye lens the "lift" or aid it requires to perform its function. Some cases of farsightedness, and in particular those of old age, demand different degrees of this aid for distant and close vision, so that two pairs of glasses may be called for, one for each type of seeing. To avoid the bother of carrying and changing two pairs of spectacles, both lenses may be combined in one set, as is done with *bifocals* (which see).

See also *refractive defects, glasses, eye,* and *sight.*

FATIGUE OF THE EYES. See *eye fatigue* and *eye strain.*

FITTING GLASSES. See *testing the eyes, glasses, buying glasses,* and *wearing glasses.*

FLINT GLASS. One of the two main basic types of glass

used in making lenses for spectacles, the other being crown glass (which see). Chemically it is what is known as a lead-silica glass, though in some instances barium is substituted for the lead. Its chief value for lenses lies in its much higher index of refraction (which also makes it valuable for cut glassware because of its brilliance and sparkle); this means that a lens of it of the same curvature as one of crown glass will have higher optical power than the other, or that a flint lens of the same power as a crown lens will be of less curvature. This is a great boon for persons requiring high power lenses for they can thus be fitted with lighter, thinner, and much less clumsy-appearing lenses than if they had to use crown glass ones. Unfortunately, flint lenses are a good deal more expensive than crown lenses.

See also *lenses* and *glasses*.

FOCUS. The eye sees an object through the medium of light rays reflected from the object to the eye. Now, to see an object means to see it clearly in all its details (every dot, bump, line, edge, scratch, etc.). But the light rays reflected from each detail of the object radiate outward in every direction and a light-sensitive screen put in their path would give simply a blur of lights and shadows. Therefore, in order to get a clear image of the object in all its details, the divergent rays from *each detail* (not merely from the object as a whole, as is usually pictured on sketches of lenses) must be converged again to form a pattern of lights, shades, and colors that reproduce those in the object which give origin to these reflected light rays; this being done with each detail results in a composite image reproducing the original object, and a screen placed at the point of convergence will show a picture of the object. This process of converging rays of light from an object to form an image of it is known as "focusing" and is a property of spherical refracting or reflecting surfaces—that is to say, usually spherical lenses, but spherical mirrors will also do it. The distance from the lens to the point of convergence of the rays passing through it (and consequently of the clear image thrown by it) is called the "focal length" of the lens. The greater the curvature of the lens (that is, the smaller the sphere of which the lens' surface is a portion), the

greater is its converging power, the shorter its focal length, and the higher or "stronger" its optical power is said to be. The optical power is customarily measured in *diopters* (which see). Naturally, it is convex lenses (those thick at the center) which are referred to here; though scientifically the same basic optical laws govern them, concave lenses (thin at the center) diverge light rays passing through them and must be interpreted a little differently. (See also *lenses.)*

In the eye there is a lens (the crystalline lens) which focuses the rays from an object to a clear image on the light-sensitive retina (see *sight).* Actually, all the transparent media of the eye (cornea, aqueous humor, lens, and vitreous humor) contribute to it, but the lens does much the greatest part. The length of the eyeball is normally such as to have the retina at the focal length of the lens when the rays are coming from objects about 20 feet or more distant from the eye. This distance is called "optical infinity" because for practical purposes the rays coming to the eye from an object at that distance or greater are about parallel and do not diverge appreciably (as would be the case with rays from theoretical infinity) and the lens of the normal eye can focus these on the retina without effort. (This, of course, refers only to the relatively very few rays from the object that are gathered in by the small opening of the eye; other rays from the object diverge outward in all directions, regardless of distance, but these do not concern the eye.) Rays from objects closer than 20 feet reach the eye diverging and the image would consequently fall behind and not upon the retina, giving blurred vision. So the eye has a little mechanism known as the ciliary muscle which automatically bulges out the lenses more for close vision, thus shortening its focal length and again giving a clear image upon the retina (see *accommodation).* When the eye suffers from certain defects—known as errors or defects of refraction (see *refractive defects)*—it cannot, regardless of the best efforts of the ciliary muscle, produce a clear focus and imperfect vision results; or, if it can achieve focus, it may call for such great and constant effort as to produce distress (see *eye strain).* The remedy for this situation is glasses—by which are held before the eyes lenses of such power as either to converge or diverge the rays coming to the eyes just the right amount;

this enables the eyes to finish the focusing of them upon the retinas without undue effort (see *glasses*).

FOOD and sight. See *diet*.

FOOT-CANDLE. A unit of illumination, being the amount of light received by a perpendicular surface when one foot from the flame of a standard candle. Since light is radiated in all directions (as if lighting the inside of a hollow sphere, the source of light being at the center), the amount of illumination a surface receives consequently varies inversely as the *square* of its distance from the source. Thus, a surface 2 feet from the light receives only ¼ the light it does at 1 foot, at 3 feet only ⅑, etc.

See also *lighting*.

FOREIGN BODIES IN THE EYE. A constant hazard to which the eye is subject is the introduction of a great variety of foreign bodies into it, anything from wind-blown particles of dust, grit, cinders, etc., to the flying bits and splinters of stone, metal, etc., that are encountered in different occupations.

Irritating under all circumstances, such bodies offer three special dangers to the eye, two direct and one indirect. By moving about and penetrating the surface of the eyeball, sharp particles may scratch and damage it, perhaps causing ulceration and doing permanent damage. This is especially to be feared for the cornea since the final outcome might be an opacity productive of some degree of blindness. A second danger is the introduction into the eye of an infection of some sort, either carried there by the particle itself or picked up later in a scratch produced by it. The indirect, but not too remote, danger is the damage that may be done or infection introduced by bungling, amateurish attempts to remove the body.

Fine dust and grit that is not sharp enough to stick into the eye or eyelid often may simply be washed or flushed out, using a dropper or an eye cup, with plain water or normal saline solution. Larger particles are usually more troublesome because of their tendency to lodge in the conjunctiva. The first precaution is to keep from rubbing the eye. (Incidentally,

the old superstitions about rubbing the *other* eye, holding out the eyelid and spitting three times, etc., to get cinders from the eyes, are totally ineffective.) If the particle has sharp corners that have stuck into the eyeball, it should be removed *only* by a doctor, as fumbling attempts with toothpicks, hairpins, loops of horse-hair, etc., may do far more harm than the particle itself. When the foreign body is freely movable on the eyeball (and medical aid is not accessible), the eyelid may be lifted by means of the lashes (being certain to have washed the hands well first) and the foreign body may be carefully and gently wiped toward the corner of the eye and thence out with the moistened (with water, *not* saliva) corner of a clean handkerchief; the handkerchief should be grasped about an inch from the corner so as to leave it flexible enough to prevent any harsh rubbing of the eyeball. Doctors often do this with a twist of cotton on a small stick or toothpick, but this is not advisable in untrained hands as a nervous twitch might jab the toothpick into the eye. If the particle is clinging to the under surface of the lid, the lashes may be grasped, the eyelid turned out by gently pressing a pencil on its outer surface while the lashes are pulled upward, and the particle wiped off with a handkerchief corner. But whenever possible, these operations should be left to a physician.

Flying chips and splinters that penetrate into the eyeball present a very delicate and special problem with which only a trained man with proper equipment can cope. Consequently, all such cases must be referred immediately to an oculist without any waste of time with home manipulations (see *splinters in the eyeball).*

Where there is any special danger of getting particles or chips in the eyes, it is wise and very cheap insurance *consistently* to wear suitable protection (see *goggles).*

See also *injuries to the eye.*

FOVEA CENTRALIS. A tiny pit-like depression in the center of the macula lutea (which see) of the retina. Here there are present only cones and it is at this spot therefore that vision is keenest. When the normal eye looks straight forward, the image of distant objects falls here and the best sight possible naturally results.

See also *retina* and *sight.*

FRAUD IN EYE TREATMENT. See *quackery and fraud.*

FUSION. The process by which a single vision of an object is obtained when looked at by both eyes at the same time. An image (slightly different in each eye) falls on the retina of each eye which sends nervous visual impulses from these images to the brain. If the eyes are so set in their sockets (as is normally the case) that the images fall on corresponding portions of the retinas, the fovea centralis for clear vision, the brain is able to combine or "fuse" the impulses from the two images into a single visual impression or reaction in the brain, which we know as vision. The two images are slightly different because the object is seen by the two eyes from slightly different positions, which to a small extent enables one to "see around" the object and sense its depth, distance, and perspectives as a whole. This is known as the *binocular effect* of the eyes (which see under *sight).* When single vision is not obtained, the brain prompts the eye muscles to move the eyes so as to have the images fall on the correct portions of the retinas and thus enable it to fuse them into one. But when for any reason the eyes are not capable of doing this, and the images of the two eyes are too widely different, the brain reacts to the impulses from each of them separately, and the person in consequence "sees double" (see *double vision).*

FUZZY SIGHT or VISION. See *blurred sight, defective sight,* and *focus.*

GAMES and defective sight. See *sports.*

GLANDS AND SIGHT. There are few, if any, of the organs of the body that do not come under the influence of the endocrine glands and their hormone secretions. To this the eyes and sight are probably no exception, but just how they are influenced by the endocrines or how disorders in them may be relieved by hormone extracts is as not yet clearly understood. It is well known that in some unhealthy conditions of the thyroid gland, when it becomes much enlarged (producing goiter), it is accompanied by exophthalmos or bulging of the eyes. This condition is often relieved by suitable treatment of the thyroid. It has been held by Dr. H. H.

Turner of Pittsburgh that, according to his observations, certain glandular deficiencies result in making shallower the anterior chamber of the eyeball, which can be restored to normal by correct glandular therapy. There has also been some experimental work done in attempting to control progressive myopia by the administration of hormones, but this has not yet passed the stage of investigation and experiment. It may well be that at some future date much will be done to correct or improve eye and vision defects by hormones and glandular extracts but that day is not yet here; and any one claiming to accomplish this should be regarded with suspicion.

GLARE. This too frequent condition in illumination has been described as "misplaced brightness." More particularly, it is a condition of lighting productive of eye discomfort and fatigue, and interference with ease and clarity of vision. Exposure to it for any length of time is certain to cause eye strain with its resultant distress (see *eye strain*). An important feature of good lighting is absence of glare. Glare may be the result of three main causes: excessive illumination, or more light than is needed for whatever is being done; improperly diffused or distributed light, leaving the light to come directly from the source into the eyes; and reflection, being in such a position in relation to the light source and a reflecting surface (glossy book-page, polished or glass-topped table, etc.) that the light is reflected back directly into the eyes—this last condition being known as "reflected glare." The remedy for the first is the regulation of the amount of light according to what is necessary for the work in hand (see *lighting*). The second is corrected by covering the source of light with shades that will cut off the direct rays, using indirect lighting fixtures, etc. (see *lighting*). Reflected glare is dealt with by eliminating as much as possible the reflecting surfaces responsible (covering shiny tables and desks with dark, dull cloths, blotter-pads, etc., using dull-finish paper for writing, etc.) and adjusting the position of the lamp or source of light in relation to oneself so that there is no reflection into the eyes. Reflected glare may be tested by placing a small pocket mirror upon one's work: if the source of light is seen in the mirror when the head is in working position, the condition

for reflected glare is present. In general, for reading, writing, sewing, and other close work, it is best to have the light falling on the work from over the left shoulder (see *reading* and *writing*). Reflected glare may also originate from conditions beyond one's immediate control—as from sunlight or headlights on the highway when driving, sunlight on the water when boating, etc.—and under these circumstances the best solution is to protect the eyes with tinted lenses that reduce the amount of light reaching the eyes (see *sunglasses*), or with the new special polarizing lenses that have the power of filtering out reflected glare while admitting direct light (see *Polaroid Glasses*). These glasses, however, cut out only reflected glare whereas sunglasses reduce the amount of light from all sources. There is also on the market a table lamp with a Polaroid screen that reduces the reflected glare from the table top, book-page, etc.

GLASSES. The purpose of glasses is to help defective eyes to see as nearly normally as possible. They do not cure the eye defect that is causing poor vision, but only alter the incoming light rays properly and sufficiently so that the impaired eyes can then handle them and focus a clear image on the retinas (see *sight, accommodation,* and *focus*). Their benefit lasts only while they are worn; once they are removed vision is as poor as ever, indeed often apparently worse by contrast with the good vision enjoyed while they were in place. Properly fitted glasses, then, will correct refractive defects of the eyes (farsightedness, nearsightedness, and astigmatism, which see) and the errors of vision resulting from muscular imbalance between the two eyes (see *cross-eyes*). However, glasses must many times be worn not to obtain better vision, as eyes with small defects may by constant effort gain clear focus, but to help the eyes get the same good sight without always being under a strain to do so, and thus relieving them of the distressing symptoms that usually accompany the condition—eye fatigue, headache, redness and burning of the lids, etc. (see *eye strain*). On the whole, glasses are meant to enable one to see better, reduce eye strain and fatigue, lessen the amount of energy and effort required to see clearly, and add generally to the ease, comfort, and efficiency of seeing.

What glasses will do in the matter of correction and the extent to which they will do it depends upon the type and power of the lenses in them, which in turn must be determined by the nature and degree of the eye deficiency (see *lenses,* and under the defect in question, and *testing the eyes).* It must not be thought, however, that all instances of blurred or dim vision means that glasses are necessary, for there are a number of bodily ills and systemic disturbances that affect the eyes and sight, the remedy of which lies in treating the underlying sickness and not just the eye (see *disease and sight).* Therefore, it is advisable to have the eyes examined and glasses prescribed, when necessary, by a competent, well-trained medical man or an oculist, not a mere spectacle-fitter or optometrist (see *examining the eyes, oculist,* and *optometrist).* The wearing of wrong glasses (especially if the error is notable) may be productive of as many ill effects as not wearing any, subjecting the eyes to possibly even greater eye strain than without any glasses, and leading to chronic headache, irritability, loss of interest in one's work, nerve strain, digestive upset, and general lowering of efficiency and well-being.

There is a superstition current that the wearing of glasses, even correctly fitted glasses, is bad for the eyes, that glasses are in effect "crutches" upon which the eyes "lean" for support, and that consequently the eyes get weaker and weaker because they are not made to stand on their own. This notion is, of course, wholly erroneous. While improving sight, glasses make the eyes themselves neither better nor worse. True, eyes frequently grow worse and require stronger glasses, but this change is due to age, disease, the nature of the defect, etc., and does not arise from wearing glasses; indeed, by relieving strain glasses may even delay such change. Further, there are some eye disorders (in particular nearsightedness and cataract) which are aggravated by failure to wear suitable glasses.

The necessity for wearing glasses is by no means unusual in our present era. The demands made on the eyes by civilization make it almost the rule rather than the exception (see *defective sight).* It is estimated that about one out of five school children needs glasses, two out of five college students require them, and when the age of 45 is reached 90% or more

of Americans must wear glasses all or part time. At the age of 70 the figures go about 95%. On the whole, two out of three adults require glasses. In the United States there are about 21 million persons who wear glasses. About 75 million dollars are spent yearly on glasses in this country. Yet only about half of those who need them actually wear glasses.

The origin, development, and improvement of spectacles present a most interesting story (see *history of glasses*)—from the crude, awkward chunks of glass of centuries ago to the great variety of precision-ground lenses available today for any of a great number of general or special needs. There are tinted, shatter-proof, plastic, and numerous other lenses corrected for various purposes; there are the little contact or "invisible" lenses that fit into the eyes; there are bifocal and trifocal lenses, combining two or three glasses in one; there are two-piece telescopic lenses for extremely bad vision; there are special periscopic lenses for reading while lying down; there are polarizing lenses for reducing glare; and so on (see *lenses* and *contact lenses*). In addition, there is an almost endless variety of style, and even color, of frames and size and shape of the lenses, enabling one to carry out almost any design or motif of dress or personal adornment (see *appearance and glasses*). One should choose glasses according to need, utility, safety, and beauty, always subject to the advice and recommendations of the oculist and optician (see *buying glasses*).

To get the best results with glasses they should be worn correctly (see *wearing glasses*) and given consistent, reasonable daily care to keep them in the best condition possible (see *care of glasses*).

It must be remembered that eyes, and especially defective eyes, frequently change, usually for the worse, and consequently require lenses different from those originally fitted to them. Thus, glasses that were once quite correct may be very much unsuited for the altered eyes and produce strain, poor vision, and other ill effects. To safeguard against this possibility, the eyes should be carefully re-examined by an oculist at regular intervals, at least once a year after one passes middle age (see *examining the eyes*).

See also *price of glasses, sunglasses,* and *goggles.*

GLASSES, BUYING. See *buying glasses.*

GLASSES, CARE OF. See *care of glasses.*

GLASSES, CHOOSING. See *appearance and glasses, buying glasses, glasses,* and *lenses.*

GLASSES, FITTING. See *testing the eyes, glasses, buying glasses,* and *wearing glasses.*

GLASSES, INVISIBLE. See *contact lenses.*

"GLASSES, SIGHT WITHOUT." See *"Sight Without Glasses."*

GLASSES, WEARING. See *wearing glasses.*

GLAUCOMA. This is one of the most serious of all disorders that may attack the eye, even more serious than cataract, for if it be too long neglected sight is permanently destroyed without the slightest hope of remedy. It is held accountable for as much as 15%-20% of all cases of blindness. However, prompt, *very prompt,* attention in its early stages gives a very good chance of saving the sight. Since the early symptoms are usually recognizable only by a trained physician or oculist, this constitutes an important reason for going to the oculist rather than to the optometrist for one's periodic eye examination; he and not the other is fitted to note this disease in its beginnings and treat it accordingly (see *examining the eyes).*

Glaucoma is often called "hardening of the eyeball," for this in a sense is what happens. The eyeball is not, as many think, an empty shell with the lens and iris hung in it, but is completely filled with "humors" that help the eyeball hold its shape within the socket. The crystalline lens divides the eyeball into two compartments (see *eye),* the larger one to the rear being filled with the "vitreous humor," and the smaller one toward the front, between the lens and the cornea, being filled with the "aqueous humor." This aqueous humor is constantly being secreted and drained away, by which process the proper tension within the eyeball is maintained. This drainage is into the lymph system by means of very tiny tubes that enter the anterior chamber at the point where the outer

edge of the iris meets the cornea. When for some reason (as yet undetermined) this drainage is interfered with, an excess of aqueous humor gathers, and pressure is built up which is transmitted throughout the eyeball; this pressure, if not soon relieved, destroys the retina and optic nerve, and blindness results.

In the great majority of instances, glaucoma comes on after middle life, and affects women oftener than men. Its cause is unknown, though it may possibly be due to some physiologic disturbance or biological poisoning of the system from a focal infection (as bad teeth, tonsils, etc.). It sometimes follows other eye diseases (as iritis or cyclitis) and injuries of the eyes. It usually attacks both eyes. It occurs in two forms: acute and chronic. The acute form comes on suddenly and without warning; there is extreme pain and redness of the eyes and general feeling of sickness; sight dims rapidly and may be entirely gone within a few hours, never to be regained unless surgical measures are taken *immediately* by an oculist. In its chronic form glaucoma may become well established before it is even noticed. There is usually no pain and at first no loss of sight. As a rule, its first indication is the recurring need for stronger and stronger glasses. It is then that the oculist will note what the optometrist will generally miss or not even look for: the weakest point in the eyeball being the "blind spot" of the retina where the optic nerve enters from the rear, the increased pressure will push this back and make a depression (the so-called "choke-disc") which the oculist will see when he examines the interior of the eyeball with the ophthalmoscope, and thus be enabled to advise the person what proper measures to take. Should the person continue merely to get increasingly stronger glasses from the optometrist as his sight grows weaker, a time will at last come when the pressure within the eye will be sufficient to destroy its nerve tissues and cause blindness. Besides the frequent need for stronger glasses, other symptoms of glaucoma are periodic attacks of blurred vision in one or both eyes, discomfort in doing close work even with the best glasses obtainable, the appearance at night of colored haloes around lights, and, in its later stages, narrowing of the field of vision, particularly on the outer side, a feeling of hardness of the eyeball when

touched, and perhaps some dilation of the pupil. When these signs are noted, one should visit the oculist without delay for a thorough examination, regardless of how recently he may have been there.

To be effective, treatment (and it cannot be too often repeated) must be as early as possible. The object is to relieve the pressure within the eyeball. In the acute form this is done by means of a delicate surgical operation in which a segment of the iris is removed so as to open a greater space for draining the aqueous humor through the little tubes at its periphery. Chronic glaucoma is often successfully treated with drugs that contract the pupil and thus pull the iris away from the cornea and open the way for drainage through the tubes. Incidentally, atropine, belladonna, or any of its derivatives must never be put into a glaucomatous eye for they will have an opposite and aggravating effect, dilating the pupil, pushing the iris toward the edge of the cornea, and further hindering drainage. When drugs fail to control chronic glaucoma, the operation must be resorted to. In these matters only expert medical men are to be considered, for bungling may do as much damage as the disease.

See also *diseases of the eye.*

GLIOMA. Tumor of the retina of the eye. There is little that can be done for this, and the result is generally partial or complete blindness, depending on the extent of the tumor.

GOGGLES. One of the most serious factors in accidental eye injuries is flying particles and splinters that may get into the eye, perhaps even penetrating to the interior of the eyeball (see *foreign bodies in the eye* and *splinters in the eyeball).* This is a hazard to which all are to some extent subject, but workers in some fields (stone-cutters, grinders, machine operators of various sorts, etc.) are exposed almost constantly to this danger. Here, as in so much else pertaining to the eyes, prevention is far better than cure. And prevention in this is so simple and effective that it is to be wondered at that it is not universally practiced. It consists simply of wearing, and *consistently wearing at all times of exposure,* adequate goggles over the eyes that will keep all chips and splinters from ever reaching them. It is estimated that 80% of industrial accidents

to eyes are caused by flying particles that goggles would have stopped. A pair of the best goggles obtainable is far cheaper than the simplest eye operation, to say nothing of the saving in pain and loss of time along with escaping the ever-present hazard of blindness that accompanies all such accidents. Most large plants even furnish goggles gratis to their workmen, yet there are many who will try to slip by on "just a little job" of grinding or the like. The danger in a one-minute job is just as great as the danger in any minute of a one-year job. To be real protection, goggles *must* be worn regularly and unfailingly *every* second of the time one is exposed to the hazard of flying particles.

Goggles may be obtained in many varieties and should be chosen according to the circumstances under which they are to be used. Where the danger is only from fine dust, glass lenses will serve; but where there is the slightest likelihood of encountering flying chips of any size, lenses of shatter-proof glass or plastic should be worn so that they will not be splintered into the eyes. To be effective, goggles should have side shields *all around* the lenses; mere spectacle goggles with open sides are only half protection. Where there is much fine dust these shields should be edged with a fluffy padding to seal them against the face. Do not buy cheap goggles if they are to be worn for any length of time at a stretch, for they are likely to have poorly made lenses with irregular surfaces that will distort the light rays and cause eye strain, with fatigue, headache, and general inefficiency as a result. Get goggles with *ground* lenses. If one requires glasses because of poor vision, it is well to have goggles made with lenses ground to prescription from shatter-proof glass, rather than to try to straddle some awkward over-size goggles over one's regular glasses. And never consider ordinary glasses a suitable substitute for goggles on a job that requires them. If in addition to flying splinters one is exposed to excessive light or heat rays (as in steel mills, welding shops, etc.), goggles with tinted lenses will supply the double protection needed (see also *sunglasses).* Persons exposed to only incidental hazard of flying objects (as foremen, inspectors, etc.), who might find regular goggles so bulky as to be tempted to dispense with them, can now get very attractive "superviser" models with

shatter-proof lenses that very much resemble an ordinary pair of rimless spectacles. These may also be obtained with light side shields for additional protection. Workers who may suffer blows across the face from heavy objects can now get adequate protection for their eyes by special new goggles consisting of a heavy rubber frame holding domed metal cups over the eyes, each cup having two fine slits crossed at right angles to permit horizontal and vertical range of vision. As additional protection against fine dust or sparks, these may be had with transparent plastic cups fitted inside the metal ones.

Always keep goggles in good repair: replace fogged or marred lenses, keep the padding around the side shields in good shape, and have the supporting straps in good condition for holding them on the face properly. And *wear them at all times* when necessary.

GONORRHEA and sight. This disease, if unchecked, may cause partial or complete blindness. It can affect the eyes in two ways: it may be either an external infection caused by the introduction of gonococci (the germs causing gonorrhea) into the eyes of a person who may be otherwise free of the disease; or it may be an internal infection carried to the eyes by the bloodstream of a person who has been previously infected with the disease. The first type was formerly an important source of infant blindness: babies born of infected mothers would get the germs in their eyes during passage through the birth canal of the mother. This danger is now almost completely obviated by the administration of silver nitrate solution in the eyes of infants immediately after birth (see *baby's eyes).* This infection may occur in adults through careless rubbing of the eyes with infected fingers, using towels, wash-rags, handkerchiefs, etc., after persons who have the disease. Its effects on the eye are terrible, running from ulceration of the cornea to destruction of the entire eyeball in extreme cases. A frequent result is opacity of the cornea, which means blindness. Internal infection is less frequent, but more treacherous: it may lie dormant and appear years after the original infection has disappeared. It is ordinarily not as destructive as the external infection, but it may affect the

deeper structures of the eye and cause some loss of vision, perhaps blindness. The treatment is, of course, the treatment of gonorrhea which formerly was very difficult to eradicate, but is of late more promising with the new fever therapy and sulfanilamide compounds. But it should never be taken lightly, and the earlier treatment is begun the better are the chances of recovery.

See also *syphilis* and *diseases of the eye.*

GRAVES' DISEASE. Exophthalmic goiter, a disorder of the thyroid gland accompanied by bulging of the eyes. See *exophthalmos.*

HARDENING OF THE EYEBALL. A popular term for *glaucoma,* which see.

HAZARDS TO THE EYES. See *dangers to the eyes.*

HEADACHE and sight. This is one of the commonest symptoms of eye strain. It is said that about 75% of those who consult oculists suffer from some variety of such pain. Of course, all headache is not due to eye strain; it may originate from a number of other sources also. But persistent headaches not readily attributable to other causes, particularly after prolonged use of the eyes, should be reason enough for a thorough examination by an oculist. Headache from eye strain may occur any place in the head; its location is therefore not significant. Its time of occurrence may vary according to the individual and circumstances: it may appear in some immediately after a period of close work, perhaps even before the work is finished, while in another it may not appear until the morning or afternoon of the day after the work was done; it may show up during a morning after an evening spent at the theatre, playing cards, reading, etc.; it may follow a period of watching moving objects, as from a train or auto; or from a number of other causes. When headache is a more or less daily matter save on or after Sundays or holidays, when the usual routine is broken and the customary use is not made of the eyes, it is an almost certain indication of eye strain. The remedy, in the great majority of cases, is simply the

wearing of correctly fitted glasses to relieve the eye strain (see *glasses*).

See also *eye strain.*

HEALTH AND SIGHT. See under *disease and sight.*

HEAT RAYS and sight. See *infrared rays.*

Helmholtz, Herman L. F. von. A German philosopher, physiologist, and brilliant scientist in many fields (born 1821, died 1894) who did extensive and accurate pioneer work on the structure, mechanism, and physiology of the human eye. Many of his findings are still accepted today and form an important part of the foundation of modern ophthalmology. It was he who first worked out and described the process of accommodation (which see) by which the eye is able to adjust itself to near or far vision through automatic change in the curvature of the crystalline lens. He first described the action of the two eyes in convergence (which see) through which single vision is obtained by the two eyes. He made important contributions on color perception and color blindness. He invented the ophthalmoscope which remains today an instrument indispensable to the oculist. He also did important work on the ear and hearing, as well as in other branches of science.

HEREDITY and eye defects. There is some controversy as to just how great a part is played in defective sight by inheritance from one's forebears, but there seems little doubt that in many instances it is present as a factor. That a certain amount of cataract, especially in the young, is hereditary now appears quite evident. It also seems that the shape of the eyeballs, a tendency for them to be too long or too short, may to some extent be transmitted from the parent, thus making heredity an influence in near- and farsightedness. The pigmentation of the eyes, or its absence as in albinism, may have a hereditary basis; this is also true of over-pigmentation of the retina, which may lead to partial or complete blindness. In color blindness, of course, inheritance is one of the chief factors, and it plays a big part in many instances of atrophy of the optic nerves, a serious condition which leads to blindness.

Inherited eye defects are, on the whole, treated by much the same means as similar defects of an acquired nature. In some cases, however, the progress of the inherited defects are not as readily halted as that of the acquired ones. About the only satisfactory way of combating them at present is by care in choosing one's mate so that both do not have the same dominant traits in reference to eye defects (which would give a fair certainty of producing the defect in the offspring); or, if a married pair finds they both possess potentially transmissible defects, by foregoing the pleasure of having children when the chances are they would be blind children. Persons, either married or considering marriage, who are in doubt on this matter had best seek expert advice on their particular case from an oculist who can examine them, determine what eye defects are present in both of a transmissible nature, and judge if they are dominant or recessive and therefore likely or not to appear in their children.

HISTORY OF GLASSES. The origin and early development of glasses is lost in antiquity and there are various and conflicting stories and legends concerning it. A tombstone at Florence, dated 1317, bears the inscription: "Here lies Salvino Armato, Inventor of Spectacles. May God pardon him his sins." But it is more than likely that glasses of some sort were employed before that time. Crystals of such a shape as to enable them to be used as lenses have been found in Egyptian tombs and among ancient Grecian ruins. According to some reports, the Roman emperor Nero (1st century A.D.) was wont to watch the gladiatorial combats in the Colosseum through an emerald lens, whether as an aid to vision or as an affectation not being made clear. The Chinese, who sooner or later are generally credited with having invented almost everything, are sometimes regarded as the discoverers of the action of lenses. One legend has it that about 2,000 years ago a Chinese mandarin picked up an odd-shaped, smooth-surfaced piece of glass and on looking through it found that he could read more easily; further experimentation led to the discovery of the principle of lenses, and finally to spectacles. Another legend asserts that long ago a Chinese wise man, Cho Tso, who lived in a sacred mountain, made crystals from the

"golden sands" of streams and placed them in frames made from the shells of sacred tortoises, the wearing of which contrivances was supposed to bring long life and good fortune. But the first strictly reliable mention of glasses is made in 1276, in Roger Bacon's *Opus Majus,* in which is found a description of the use of the convex lens for helping vision; for this reason Bacon is sometimes given the honor of being the inventor of glasses, but this is most unlikely. Thereafter, reference to glasses becomes more and more frequent in the writings of the Middle Ages. During this time the use of glasses was not widespread, being confined chiefly to the clergy and a few other scholars. The great mass of people were unable to read or write and therefore did not especially need them. But when, in the fifteenth century, printing by type was perfected and reading matter was suddenly made much more available, eyes began to be used more generally for close work and the need for glasses grew in consequence. By the end of the century lens grinders were established in practically all the important towns of Europe. So great was this increase that in 1629 Charles I of England granted a charter to the Spectacle Makers' Guild. From then on improvement, both in quality of lenses and methods of grinding them, has slowly but constantly gone on. There has been a sudden impetus in recent years through the superior grades of glass now available and the great advances made in precision machinery, going through the "bifocals," invented by Ben Franklin, and probably reaching its acme in the "invisible glasses" or contact lenses. Similar advance and improvement have taken place in the frames holding the lenses. Originally probably a single lens was held by hand before the eye. Early Chinese shell frames were bound awkwardly in place by strings going around and over the head. Clumsy bone and horn frames gave way gradually to thinner steel frames, and then to gold and silver. Cumbersome supports were replaced by temple bows that pressed against the sides of the head to hold the frame in place, and finally to the far more comfortable ear-hook temples. Today, with light, strong plastics in almost any conceivable color or completely transparent, with non-corroding metallic alloys of many kinds and colors, and with inconspicuous rimless mountings, we are able to choose highly efficient

glasses in an almost endless variety of styles. We are truly living in the "golden age" of spectacles.

See also *glasses* and *lenses.*

HOMATROPINE. This is the drug commonly used in the "drops" that the oculist puts into a person's eyes in making a complete examination of them. It has a temporary paralyzing effect on the muscles of accommodation of the eye, thus enabling the oculist to make his examination with the eye relaxed and completely at rest and with the pupil dilated.

See *"drops," cycloplegics,* and *examining the eyes.*

HORDEOLUM. A stye, which see.

HYGIENE OF THE EYES. See *care of the eyes.*

HYPERMETROPIA. Farsightedness, which see.

HYPEROPIA. Farsightedness, which see.

HYPERPHORIA. A condition in which the line of vision of one eye tends to point upward above that of the other, and that eye will consequently "see higher" than the other in looking at a given object. The result will be eye strain, distress, and imperfect vision, with perhaps some degree of double vision in extreme cases. This defect may be corrected by suitable prismatic lenses or possibly by orthoptic training. This disorder is not frequent.

i-bath. A patent eyewash alleged by the manufacturers to "cleanse and cool" tired eyes and to "relax eye muscles." Any preparation that actually would relax the eye muscles should not be put into the eyes save as directed by a physician, and as far as any cleansing and cooling effect is concerned, every bit as much benefit may be obtained from plain water or normal saline solution, at much less expense.

See also *eyewashes* and *quackery and fraud.*

ILLNESS AND SIGHT. See *disease and sight.*

ILLUMINATION. See *lighting.*

ILLUSIONS, OPTICAL. See *optical illusions.*

INDUSTRY AND SIGHT. Certain occupations (as grinders, stone-cutters, riveters, pneumatic drill operators, etc.) offer a constant hazard to sight through their ever-present danger of injury to the eyes from blows, perforations, and flying dust, chips, or splinters (see *injuries to the eye).* Other jobs (as chemical workers, etc.) subject the eyes to the chance of damage through the action of corrosive fumes or gases. X-rays and excessive infrared and ultraviolet rays also offer a hazard in certain professions. The most important measure to be taken in this matter is to prevent such accidents from occurring, by arranging machinery, working position and routine in such a manner as to lessen as much as possible the opportunity for accidents; by providing adequate ventilation to carry off dust and fumes; by supplying suitable guards of shatter-proof glass, and, most important of all, the wearing of adequate goggles, with tinted or special lenses if dangerous rays are present, to protect the eyes of all workers subject to this hazard (see *goggles).* If in spite of all precautions accidents do occur, then prompt, *expert* care and treatment by medical men (not by the shop handy man or the foreman) offers the best chance of saving the sight.

See also *foreign bodies in the eye, splinters in the eye, acid,* and *alkali.* A complete treatment of this subject will be found in *Eye Hazards in Industry,* by Louis Resnick, Columbia University Press, New York, 1941.

Inecto Rapid Notox. A patent eyelash dye which has been condemned as dangerous because it contains aniline dye as the coloring agent; if this gets into the eye, it may cause serious damage to it and to sight. See *beautifying the eyes* and *quackery and fraud.*

INFLAMMATION OF THE EYES. See *conjunctivitis.*

INFRARED RAYS and sight. These are the rays from the lower end of the spectrum, below the visible red light rays, whose wave-length is too long to fall within the range of sensitivity of the eye and which consequently are invisible to the human eye. These are the rays that transmit most of the heat from sunlight and artificial sources. In great excess and concentration they will prove harmful to the eyes, but in the

amounts encountered by the average person in ordinary life they are not likely to be injurious, certainly not to the extent hinted by advertising for some brands of sunglasses or special tinted lenses for eyeglasses. The average person requires no protection in this direction. Those whose work exposes them to dangerous amounts of these rays can get protection with tinted lenses or lenses of special glass that filter out the rays, either in the form of ordinary sunglasses or fitted in goggles (see *sunglasses*). If the amount of heat rays is unusually great (as with some jobs in steel mills, etc.), it may become necessary to provide some additional safeguard (as a metal or heavy heat-resistant glass plate, wire netting, a net-work of water-cooled pipes, or the like) to shield the worker.

See also *ultraviolet rays* and *x-rays*.

INGROWING LASHES. See *trichiasis*.

INHERITANCE OF EYE DEFECTS. See *heredity and eye defects*.

INJURIES TO THE EYE. The eye is an organ as delicate as it is sensitive. Nature fortunately provided it with extremely good natural protection, setting it deep in a strong, bony socket, cushioning it on layers of resilient fat, providing it with lids that close and cover it automatically at the approach of danger, and furnishing it with a protruding, overhanging brow that serves to ward off the majority of blows that may fall across it.

Nevertheless, the eye is almost constantly subject to some degree of danger of potential accidents that may damage it. It is estimated, on quite reliable figures, that in this country alone there is each year lost (not just injured, but lost) about 2,000 eyes in industry. In addition, there are every year in American industry about 300,000 eye injuries, about 1,000 per working day, that incapacitate the worker for at least a day, often much longer, *98% of which could have been prevented*. The yearly direct loss from eye accidents is calculated to be about $50,000,000, while it is figured that the indirect loss to the worker (in subsequent reduced earning power, etc.) and his community is about $100,000,000 each year, with a similar amount as the cost to the employer.

It may thus be seen that eye injuries constitute no negligible problem. Though the majority of them happen in industry (to which the above figures apply), daily and home life offers ample opportunity for their occurrence, also mostly preventable. Though no figures on this phase of the matter are presently available, their number is not insignificant. As soon as children are out of the cradle their eyes seem to become the focus of an amazing amount of mishaps, actual and potential. Pointed toys, sharp sticks, toy swords, firecrackers, "BB" guns, sling-shots, rubber bands, baseballs, stones, snowballs, and a host of other objects dear to children often seem to be inspired by no other purpose than to get into children's eyes. It is the duty of parents so to train their children, guide their play, and govern their choice of toys as to reduce this hazard to the absolute minimum (see *children's eyes).* The safeguarding of the eyes thus begun should be unremittingly continued throughout life (see *care of the eyes).*

Eye injuries are of three main sorts. The commonest are those that result from something getting into the eye and causing damage: either small, sharp particles that may fly into the eye (see *foreign bodies in the eye* and *splinters in the eye),* or corrosive substances or fumes that may splash or otherwise get into the eye (see *acid, alkali,* and *tear gas).* Secondly, there is a variety of blows and wounds that may be suffered directly by the eye. A blow directly on the eyeball can lead to many disorders: the lens capsule could be ruptured, possibly bringing on cataract; there might be hemorrhage into the aqueous or vitreous humors; there could be rupture of the choroid; or there could be brought on changes in the retina that would leave serious defects in vision. Perforating wounds to the eye will almost invariably cause some loss of vision and often blindness. They may come from unusual and generally unforeseen sources: pointed tools, game-room darts, and the like obviously carry this danger, but a surprising number are due to stab paper files, straight-spout oil cans (they point upward on a table and a person unthinkingly bends over and strikes his eye on them), ends of wire coat-hangers run into on sticking the head in a dark closet, sharp branches in the garden or woods, and a host of similar devices generally regarded as harmless. Thirdly, there are some

damaging rays and radiations to which the eyes may unknowingly be exposed. Every one is liable to the harm of improper illumination (see *glare* and *lighting),* while in certain jobs and professions there may be encountered rays hurtful to the eyes in excess (see *infrared rays, ultraviolet rays,* and *x-rays).*

Not infrequently injury is done the eyes in foolish efforts to improve beauty (see *beautifying the eyes).* Also, patent medicines and nostrums put into the eyes through self-medication of some eye irritation or ailment may do them additional harm instead of helping them (see *patent medicines* and *quackery and fraud).*

No eye injury is to be taken lightly: they are almost certain to cause at least temporary sight impairment, along with pain, discomfort, and possible loss of time and money; and they may mean permanent damage to the eye and sight, perhaps blindness. Injury to an eye carries an additional disadvantage over that to another member: the two eyes being so intimately linked in their functioning, there is always great likelihood of injury in the one bringing on sympathetic inflammation, pain, and sight disturbance in the sound eye.

The best remedy in this matter is, of course, to prevent accidents from ever occurring in the first place. This is to be done by daily care and caution as one goes along; not needlessly putting the eyes in situations that endanger them; not having carelessly about objects well suited to injure them; by the employment of suitable protective devices when the eyes must be placed in positions of danger, as goggles, and tinted or special lenses to filter out objectionable rays (see *goggles* and *sunglasses);* sports masks; and by putting nothing in the eyes that is not prescribed by a physician (see *eyewashes).* If in spite of precautions injury does occur, the next best remedy is the promptest and most expert medical attention available; and this means a graduate physican or oculist, not some quack practitioner or home remedy.

See also *diseases of the eye.*

"INVISIBLE" GLASSES. See *contact lenses.*

IRIS. A ring-like membrane, continuous with the choroid, suspended before the lens of the eye and having at its center an opening, the pupil, through which are admitted light rays

to the interior of the eyeball. It contains pigment cells the amount and distribution of which give rise to the variations in the color of eyes (see *color of the eyes).* It is supplied with tiny muscle fibers that react to light intensity, making the pupil smaller as the light gets brighter and larger as the light gets dimmer; this governs the amount of light reaching the retina and plays an important part in accommodation to light (see *accommodation).* See also *eye* and *sight.*

IRITIS. Inflammation of the iris (which see). Symptoms are intense pain, not only in the eye itself but also in the brow, temple, and perhaps cheek on the same side of the head, a blurred appearance of the iris, irregularity of outline and unusual smallness of the pupil, and sometimes redness of the eye and painful sensitivity to light. It commonly results from systemic poisoning or focal infections (as from teeth, sinuses, tonsils, etc.) and often accompanies rheumatism. This is not a disease to be slighted for the inflamed iris throws off a gummy exudate around the pupil which may cause it to adhere to the lens, and perhaps entirely fill the opening, with consequent loss of sight. If treated promptly, the chances of recovery are good. But this means *expert* treatment, by a trained oculist, for the wrong medicine will add to the harm. Atropine is usually put into the eye to dilate the pupil and thus keep its edges from adhering to the lens. This is exactly the opposite of what is required for glaucoma, with which this disease is often confused by the inexperienced. It would be foolhardy for one to attempt to treat himself with patent "drops" as the chance of working exactly the wrong effect, with dire consequences to sight, is extremely great.

See also *diseases of the eye.*

KERATITIS. Inflammation of the cornea of the eye. It may occur in a great number of forms and variations. If not promptly corrected, it may lead to ulceration and opacity of the cornea with partial to complete loss of sight. It is sometimes found in young people as a consequence of inherited syphilis. As with other eye disorders, the earlier treatment is begun the better the outlook for cure.

See also *diseases of the eye.*

KERATOCONUS. A condition in which the cornea becomes thinned (without inflammation) and consequently bulges outward and assumes something of a conical shape. There has been some success of late in correcting this deformity by the wearing of properly ground contact lenses.

LACHRYMAL GLAND. This small gland (of which there is one for each eye) is situated in, but toward the front of, the eye socket above the outer corner (the one away from the nose) of the eye, just above where the upper eyelid comes in under the brow. It is similar to the salivary gland of the mouth. Its purpose is to secrete or furnish tears which flow slowly and constantly to lubricate the eyelids as they slide over the eyeball, and to help keep the eyeball clean and moist. See *tears*.

LAMPS. Two of the most important phases of correct illumination are providing adequate general light for routine moving about and non-detailed seeing, and suitable particular light at certain places where special close or detailed work is to be done. One of the best and the customary means of accomplishing this latter purpose is by properly designed and placed lamps. Lamps are obtainable in a great variety of styles: table, floor, bridge, bed, desk, pin-up wall lamps, and other less popular kinds. There are good and bad ones in each style. Naturally, the choice of a lamp is subject to a number of factors—personal taste, furnishings of the room in which it is to be used, and the purpose for which it is to be used—but there are certain specifications which all lamps should meet, the more important of which follow:

The lamp should not permit light to shine directly into the eyes; the shade must be long enough and low enough to prevent this. If the bulb can be seen from the working position, it is wrong.

The shade should be wider at the bottom than at the top so as to allow the light to spread; it should be heavy enough so that the outline of the bulb cannot be seen through it; it should have no cracks or joints that let the light shine through into the eyes; and it is best when it has a white or light and smooth lining that gives maximum reflection of light on the work.

The lamp should be high enough to permit working to one side of it, not directly under it; this also permits more than one to use the same

lamp. In general, table lamps should range from 19 to 28 inches in height and floor lamps from 58 to 63 inches.

Lamps should be placed in correct positions in reference to one's work. This means mainly that ample light should fall upon the work while the position is such as to prevent light being reflected from the work or table-top back into the eyes, giving what is called "reflected glare" which is productive of eye strain. In general, the best position is to one side. Never should the lamp be placed in front of one as this is almost certain to give reflected glare. Nor should the lamp be too much to the rear when reading as the tilted pages may reflect into the eyes. A simple test for reflected glare is to place a small mirror on the work or book; if the lamp bulb can be seen in the mirror conditions are such as to give reflected glare. Polaroid lamps (which see) cut down reflected glare. Lamps bearing the I. E. S. label (Illuminating Engineering Society) are carefully made to meet specifications for correct illumination and can be relied upon.

Keep correct wattage bulbs in lamps. The most certain way to determine this is by means of a light meter. Most local light companies will send out a man with a meter to test one's lighting. In general, the average simple shaded lamp should have at least 75-100 watts in it, while lamps with diffusing bowls should have 100-300 watts.

See also *lighting.*

Larieuse. A patent eyelash dye condemned as dangerous to the eyes because of the aniline dye it contains. See *beautifying the eyes* and *quackery and fraud.*

LASHES. See *eyebrows and eyelashes.*

Lashgro. A patent preparation alleged to make the eyelashes grow "long and alluring." Such a claim is ridiculous because there is no known local application capable of promoting hair growth anywhere on the body. Consequently, such a product is certain to prove a waste of money and may contain ingredients that would prove hurtful to the eyes. See *beautifying the eyes* and *quackery and fraud.*

Lash-Lure. This is the best-known of all potentially harmful eyelash dyes. For its coloring agent it contains aniline dye which constitutes its chief hazard to the eyes should any get into them. That lash dyes frequently get into the eyes is well proven by the number of cases of eye injuries, and at least one instance of permanent blindness, that followed the use of

this preparation. Not that this product is in itself more dangerous than a number of similar ones, but its power for harm is enhanced by the wide advertising it receives. See *beautifying the eyes* and *quackery and fraud.*

LENSES. Lenses, held before the eyes by means of spectacle frames, are the customary and to date the most satisfactory means of correcting refractive defects of the eyes. Lenses as employed in glasses are of three fundamental types: spherical, cylindrical, and prismatic—so named after the type of geometrical object of which their surfaces form a portion. Spherical lenses are of two varieties: convex and concave. The convex lens (thick at the middle and thin at the edge) converges light rays passing through it; some form of it is used for farsightedness. The concave lens (thin at the middle and thick at the edge) diverges or spreads light rays passing through it; it is used for nearsightedness. Almost all modern lenses, even those for nearsightedness, appear at first glance to be convex as they all bulge outward. This is done by modern grinding methods to give the eye a wider range of clear corrected vision, wider than would be possible with the simple straight lens of earlier years, for the eye is more or less "in" the lens much as a person may be in a bay window and get a better view up and down the street. But such a lens may still be concave or convex so far as optical properties are concerned simply by being ground with the center thinner or thicker than the edge. Cylindrical lenses may also be convex or concave, producing convergence or divergence also, but along the line of the cylinder of which the surfaces are a part, not toward a single point on the axis of the lens as with spherical lenses. Cylindrical lenses are used to correct astigmatism and must be placed before the eye at the angle of the defect (see *astigmatism).* Frequently, both cylindrical and spherical surfaces must be ground into the same lens to correct defective sight. Prismatic lenses are, as their name implies, prisms, fundamentally being wedge-shaped pieces of glass with both surfaces flat and tapering from one side of the edge where it is thickest, through the center, and on to the opposite side where it is thinnest. In practice, however, these lenses also bulge outward as the others, but the prismatic effect is there through the uni-

form tapering of the surfaces across the lens. Such a lens has the property of bending light rays to one side without convergence or divergence between the rays themselves. It is used in cases of muscular imbalance to correct double vision by so bending the light rays that the image in the bad eye falls on the proper portion of the retina to give single vision (see *double vision).*

These are the basic lens forms employed in the correction of defective sight by glasses. In many instances it is necessary to combine some degree of more than one of these forms to achieve complete correction. It is also necessary that the lens be of the proper power for the needs of the individual eye (see *focus* and *testing the eyes).* Lenses may also combine with the above some other properties, in particular that of filtering by which are "strained out" from the incoming light certain rays which might prove hurtful to the eyes in excess. The commonest method has been to tint the lens which shuts out much of glare, ultra-violet rays, etc. (see *sunglasses).* Lately there have been perfected some glasses of special composition which, while clear in appearance, have within themselves the power of taking out certain rays. This glass can now be made so as to filter out rays of practically any wave-length desired from the infra-red to the ultra-violet. Lenses from this glass are especially useful in certain professions where harmful rays are encountered in abundance (see *infrared rays, ultraviolet rays,* and *x-rays).*

There have been immense improvements made in lenses in recent years, in design, accuracy of grinding, the glass from which they are made, etc. Lately amazing results have been obtained in increasing the light-gathering power of lenses by applying to them very thin "coatings" which cut down the amount of light reflected from them and therefore lost to a great degree. Also, the transparency, and thus the efficiency, of lenses has been augmented by a chemical treatment that removes the extremely thin layer of oxides found to cling to their surfaces and impair their clearness. We may undoubtedly expect further advances in this field in the years to come.

The above are the basic features that may be incorporated, singly or in combination, in lenses. The lenses in turn are available in a variety of styles open to choice according to the

need, purpose and taste of the individual using them. Each of the commoner of these particular styles is described elsewhere: see *bifocal lenses, contact lenses, eikonic lenses, myodisc lenses, plastic lenses, telescopic lenses, Tillyer lenses, toric lenses,* and *trifocal lenses.* See also *crown glass* and *flint glass.*

A given type and style of lens is usually obtainable in several grades or qualities. Since lenses are manufactured in huge quantities, a portion of them are bound to come out imperfect. These should be destroyed, but it is the practice of some optical manufacturers to sell these "seconds" at a much lower price. Certain unethical dealers will buy these up and foist them on the public as "just as good," and since the average man knows little about the matter he will often innocently buy them thinking to save a little money. Now, while the price of spectacles is too high (see *price of glasses),* too cheap lenses may prove most expensive in the long run. A poor lens may hold in itself more optical defects (not apparent on superficial examination) than the defective eye to which it is applied, and the combination of the two may result in poorer vision, eye strain, and general discomfort, until finally correct glasses will have to be purchased anyway. While one should be careful not to overpay, it is a grave error ever to risk sacrificing quality in lenses to mere price. The average person buys too few lenses in his lifetime to make it worth while. The solution is to deal only with ethical, adequately trained men (see *buying glasses).*

See also *glasses.*

LENS OF THE EYE. This, known more fully as the *crystalline lens,* is a small, crystal-clear body within the eyeball directly behind the iris. It is biconvex in shape, thick at its middle and thin at its edges, and its purpose is to focus the light rays coming from an object to a clear image of the object on the retina (see *focus).* It is of an elastic nature that permits its shape to be altered. It is enclosed in a thin, strong, transparent membranous sac or capsule which is fastened all around its edge to the choroid. From the central portion of this membrane run a series of tiny fringe-like muscle fibers (the ciliary muscle or body) which extend outward to fasten to the choroid. When these muscles contract they pull the

center of the membrane outward, easing its tension on the lens and allowing it to bulge and become thicker through its middle, thus shortening its focal length—a condition that is necessary for a normal eye to see close objects clearly (see *accommodation*). The lens may become opaque from certain causes and thus produce what is known as cataract (which see).

See also *eye* and *sight*.

LIGHTING. An element indispensable to sight is light. Before an object can be seen there must be light rays to be reflected from the object to the eye seeing it (see *sight*). If there is no light there is no vision, regardless of how many objects may be present or how keen may be the eye. A person with the sharpest sight is no better than a totally blind man in complete darkness.

But mere light is not enough; *proper* lighting is imperative for good vision, as well as for the preservation of the eyes. Poor lighting is a very important factor in the causes of defective eyesight. In turn, defective and aged eyes require more than ordinary amounts of light, so that the whole matter may easily develop into a vicious circle. Inadequate illumination often causes not only eye strain, but general bodily fatigue and tension as well. Correct lighting, therefore, besides protecting the eyes will pay big dividends in personal comfort and efficiency, in the home as well as in the office and factory, and is well worth the moderate effort required to achieve it.

The problem of lighting is largely an outgrowth of the perfection of artificial light, which has been known in a satisfactory form for little more than a century. Before that time mankind generally did its work outside and during daylight, and used the dark hours for relaxation and sleeping. Before the machine age and the advent of universal education, there was little demand on eyes for close use in precision work, reading and writing, etc., in natural or artificial light. But recent developments in civilization, especially as to the many types of close eye work and the advances in artificial illumination which have increased the hours during which the eyes are used, have brought about many visual problems not known in earlier times. These problems are to be solved mainly through

the combined efforts of medicine, optometry, and illumination.

Contrary to popular opinion, artificial lighting is not in itself harmful to the eyes; it is only when it is incorrect that it will do damage, and this is equally true of daylight. Daylight, too, must enter into any consideration of proper illumination.

The two worst features of lighting are as a rule inadequacy of amount and glare (see *glare*). Lighting to be good must be sufficient, uniform and diffuse without sharp contrasts of light and darkness, free from glare, and without shadows. Thus, in substance, the whole problem of illumination may be brought down to three main factors: amount, kind, and arrangement.

As to amount, this is largely a matter of having a light source of sufficient strength to supply, at whatever distance it happens to be, ample light for the purpose for which it is being used. With daylight this is chiefly a question of enough and large enough windows, but most of all it concerns light bulbs in relation to the type of work being done, for whenever daylight is insufficient artificial light must be used to supplement it. The following table gives the minimum amounts of light recommended by illumination engineers as sufficient for the indicated purposes. This is the amount of light that should *fall upon* the work, not merely be present somewhere near by. It is also the *minimum* amount; more is generally preferable so long as none of the other rules of correct illumination is violated. (See *foot-candle* for definition of that unit.)

For general non-detail work, routine housework, dining, card-playing, etc.	5- 10 foot-candles
For general home, office, and factory illumination without fine work, coarse detail work (as knitting, etc.), detailed house work (as ironing, etc.), reading large print, children's play, etc.	10- 20 foot-candles
For ordinary not too prolonged reading (as of newspapers), routine clerical work, studying, ordinary sewing and mending (on light-colored materials), drawing, carpentry, general shop work, etc.	20- 50 foot-candles
For general fine work, prolonged reading of small print, fine needlework, sewing on dark materials, fine machine or shop work, inspection, etc.	50-100 foot-candles

For very fine work, engraving, watch repairing, reading very fine or blurred print, etc. ..... 100-150 foot-candles

The strength of light sources is today almost entirely a matter of size of electric light bulbs. There is an erroneous notion that light is strictly a matter of total wattage, that one large bulb gives no more light than several smaller bulbs of the same total wattage. Actually, one 100-watt bulb is equivalent to two 60-watt or six 25-watt bulbs in light-producing power; for a given amount of light, larger bulbs will save both on electricity consumed and the price of the bulbs. As for the amount of light given off, a 40-watt bulb will give about 9 foot-candles at a distance of two feet, a 60-watt bulb about 16 foot-candles, and a 100-watt bulb about 32 foot-candles. Remembering that doubling the distance from the source of light decreases the amount of light to *one-quarter* (not one-half), it becomes a relatively simple matter to compute the approximate amount of illumination on a given surface by noting the size of bulbs and their distance from the surface, and to make any necessary corrections in keeping with the above table of desirable light intensity for different occupations. Clear glass and inside frosted bulbs give about the same amount of light for a certain wattage. The frosted ones give a more diffuse light and hence tend to reduce glare, but they must never be considered a substitute for a diffusing bowl or shade; they may be used bare only for incidental, short-time lighting, as in closets, basement corners, porches, garages, etc. The final test for correct intensity of illumination is, of course, the light meter. This is a small instrument consisting of a photo-electric cell connected with a sensitive galvanometer which is calibrated directly in foot-candles. When placed on a surface it gives an immediate reading of the amount of light falling upon that surface. The local electric companies in most of the larger communities will send out a man with one of these meters on request to check the correctness of the illumination in one's home and to make any necessary suggestions for improving it.

The second aspect of lighting, kind, resolves itself mainly into types of light fixtures. There are four basic types: direct, indirect, semi-direct, and semi-indirect, so named according to the sort of illumination they deliver. The direct is some

form of the simple reflecting shade above the bulb. It sends most of the light directly to the illuminated place. It gives the brightest light of all for a certain wattage, but has two great disadvantages: glare and sharp contrasts between bright and dim areas. The indirect has a reflecting shade below the bulb which stops any direct rays from reaching the working surface, sending them instead first to the ceiling and upper walls whence they are reflected back to the work positions. This gives a soft, diffuse, uniform light without glare or sharp contrasts and with a minimum of shadows. However, its intensity is rarely high enough for close or fine work (unless very large, and expensive, sources are employed), and is consequently best suited for general room illumination. Naturally, to be efficient this type demands light-colored ceiling and walls, but without too shiny a finish. Some floor lamps with metal reflecting bowls give this type of light in a portable form. The semi-direct is some variety of translucent bowl completely enclosing the bulb, like the conventional kitchen ceiling fixture. This sends out a good portion of its light directly to the working surface, but in a more diffuse and glareless form than the direct, while sending the rest of its light upward and outward to be reflected back indirectly for general illumination. This type provides general room illumination while giving enough direct light near it for moderately close work. The semi-indirect is a translucent shade placed beneath the bulb, open at the top. It sends most of its light to the ceiling to be reflected back generally, while passing a certain amount through the shade in direct illumination of a diffuse sort. This gives more direct light than the indirect fixture, but not enough for very close work, unless hung quite low. It is good for general office illumination and the like, supplemented at need by lamps. This type may be had in portable form in lamps with translucent reflecting bowls which, when properly shaded, provide an excellent kind of light for close work.

There is a distinctly new type of light fixture, the fluorescent with its long white tubes, which appears to be a real advance in the field of illumination. Not only is it more economical for a given amount of light, but the kind of light it gives off seems much nearer the ideal than any previously

known. It is adequate without being harsh, wonderfully diffuse and uniform, and almost entirely without glare or shadow. The installation cost is at present somewhat higher than the customary types, but this may be compensated for by the lower operational cost and greater suitability and efficiency of lighting. Any one contemplating changes in lighting fixtures will do well to investigate this type.

The third factor in lighting, arrangement, is mostly a matter of placing fixtures, windows, etc., in relation to the work (or the work in relation to them) in order to obtain ample diffuse light without undue glare or shadow. There are two aspects to this matter: general illumination for giving adequate uniform light throughout the room, and additional particular illumination at the places of prolonged close or fine work. The first is a matter of choosing among the types of fixtures described above according to the needs of the work being done and the physical circumstances of the room, supplying them with the proper size electric bulbs, and checking the results for sufficiency and glare with a light meter and a mirror (see *glare*). The second is a question of suitable lamps, which is discussed elsewhere (see *lamps*).

No negligible feature of illumination is the handling of daylight to meet the same standards set for artificial light. This, of course, is fundamentally an architectural problem in the correct size and placing of windows, and is difficult to alter much after a building has been constructed. Also, daylight is so variable (season to season, morning to evening, cloudy to bright weather, etc.) that it is practically impossible to reach a solution satisfactory at all times. Daylight, especially as combined with sunlight, lends itself readily to glare, contrasts, and shadows. Some architects meet the situation simply by cutting out windows entirely and supplying adequate artificial illumination, which can be relied upon not to vary. Glass brick are frequently better than conventional clear windows for giving diffuse and glareless light. While correctly handled daylight is indubitably the finest sort of illumination, there should always be sufficient and proper facilities for artificial lighting to compensate for the deficiencies of daylight when they occur.

Once a suitable illumination system has been established,

it is not to be forgotten and left to take care of itself. Its continued adequacy depends upon its careful and consistent maintenance. Fixtures, shades, bulbs, windows, etc., are to be kept clean and clear; ceilings and walls are not to be permitted to become smudged and darkened, particularly where indirect lighting is used; any damage that may affect lighting—cracked or broken shades, loose contacts in the sockets, worn cords, etc.—is to be promptly repaired; burnt-out and old dimmed bulbs are to be replaced without delay; and lighting arrangements are to be altered to meet any changes made in working conditions or type of work. It is advisable to check the correctness of illumination with a light meter at regular intervals.

See also *reading* and *writing.*

LONG SIGHT. Farsightedness, which see.

LOTIONS for the eyes. See *eyewashes.* See also *beautifying the eyes* and *quackery and fraud.*

LYSOZYME. An antiseptic substance naturally present in tears which has the power normally of destroying most of the ordinary bacteria that may get to the eye. Were it not for this natural protection, infections of the eye would be far commoner than they are.

See also *tears.*

MACULA LUTEA. This, known as the "yellow spot" because of its pigmentation, is a small, slightly depressed, oval area, about 3 millimeters across, of the retina located opposite the crystalline lens. It is slightly above the true geometrical straightforward axis passing through the lens; thus the visual image of objects slightly below this axis (as is the case with the majority of ordinary seeing) will fall directly upon this spot. In the center of the macula is a tiny pit-like depression (the *fovea centralis,* which see) in which the light-sensitive nerve endings are cones exclusively; this is the portion of the retina that gives acutest vision. As one moves outward toward the edge of the macula, rods are scattered among the cones and become more numerous as the cones become less, until at the margin there are rods only. Since only the cones are sensitive

to color and are more sensitive than the rods to detail, it is on the macular portion of the retina that detailed form and color of images are perceived. The rods, on the other hand, are quicker and keener to perceive light and will, for example, much sooner sense the image of a moving object than will the cones. Thus, images of objects to one side of the visual axis, say a moving automobile which one sees from the "corner of the eye," will quickly if vaguely be sensed by the rod-portion of the sides of the retina, giving what is known as "peripheral vision." This perception will prompt certain muscles to move the head and eyes to point directly at the object, and the image of the object will then fall upon the macula, giving what is called "macular vision," and its perception will then be fully detailed and colored. This process is gone through repeatedly in daily seeing; it is done instinctively and so quickly that one does not realize its action.

See also *retina, eye,* and *sight.*

MAGNIFIERS. Persons with an advanced degree of sight deficiency frequently experience special difficulty in seeing very fine detail or reading unusually fine print (as in telephone books), even when bringing it quite close to the eyes. For the occasional accomplishment of this for short periods, magnifying glasses are found to be very serviceable. These are simply large biconvex lenses, usually mounted in a heavy protective frame with a handle which, when held a short distance from the page, produce a magnification of 3-4 times or more of the print or detail there, enabling it to be discerned readily. The old "reading glass" with which our grandparents used to read the finely-printed Bible is an example. Large cylindrical lenses are also obtainable, some types mounted on legs to hold them the correct distance from the page, as they will magnify the whole length of a line of print at a time without moving the glass, which must be done with the other. There is also available a special device (the Pike Electric Reader) which is simply a large bi-convex reading glass of the customary type supplied with a small electric bulb (lighted by batteries in the handle or by a plug-in cord) which throws its light directly down upon the matter being magnified and insuring sufficient light for it to be seen; this device is most

useful since the large lens and the person's hand held so close to the page tends to block the light.

See also *lenses.*

MAIL-ORDER GLASSES. This is a form of eye quackery that was formerly more prevalent than today, but is by no means extinct, particularly in rural districts. Business is commonly solicited through ads. It takes various forms: sometimes an agent will call with a number of spectacles from among which one chooses the best "fit" by trial; or a set of test glasses in various size frames may be sent, of which the customer tries one after the other and returns them all to the company with the number of apparently the most suitable one, and later receives one like that (which is the same deplorable method generally employed in five-and-ten stores, though they supply the chosen spectacles immediately from stock); or a traveling agent may solicit trade, "test" the eyes with equipment carried with him, send in the "prescription" to the company, and the glasses are received later by mail. There are other variations of this type of quackery. These glasses are as a rule cheap "seconds," both frames and lenses, or products cheaply made for the purpose. They are sold to the individual according to the best approximation to his needs in keeping with the stock and conscientiousness of the dealer—if indeed he bothers any further than to distinguish between nearsightedness and farsightedness and then to choose more or less at random. When it is realized that correct lenses must be ground for the defects of *each* eye of *each* individual, that frames must be properly fitted to each person's face, that the lenses must be correctly adjusted in the frames so that their optical centers come where they should before the lens of the eyes, it will be understood that there is hardly a chance in the world that any one buying such glasses will obtain either a good face, frame, or optical fit, to say nothing of the correct combination of all of them. Incorrect glasses can cause much eye strain and discomfort, and often increase the eye defect, and nothing short of a miracle can prevent such glasses from being incorrect. Consequently, no person should even contemplate buying or wearing spectacles of this type, much less doing so.

See *glasses, buying glasses,* and *quackery and fraud.*

MAKE-UP for the eyes. See under *beautifying the eyes.*

MASCARA. See under *beautifying the eyes.*

MASSAGE of the eyes. Massage is one of the oldest physical therapeutic agents in the history of medicine. Properly applied, it is of distinct benefit in many disorders, but the popular mind tends to regard its efficacy as very nearly universal. Despite its frequent benefits, there are some organs and diseases to which massage may not safely be applied in numerous instances, and to this group belongs the eye. Not only is the eye so constituted that its disorders will not yield to massage, but its structure is such as to be in danger of injury by this treatment. Further, there are some serious diseases of the eye (as cataract and glaucoma) which may be very much aggravated by pressure and rubbing, and any irritation of the conjunctiva may be increased by it. Besides, unless most carefully and hygienically performed, it offers an excellent opportunity for introducing infection into the eye. And if eye massage is ever to be helpful in rare instances, it will certainly not be the amateurish variety one would practice upon himself, but only that done by an expert as ordered and directed by a physician. Consequently, all general advice for eye massage, from friends, quack "courses," etc., or mechanical gadgets for giving it, is to be strictly disregarded. The above, of course, refers to the eyeball or area directly around it, and not to gentle massage of the temples, forehead, etc., to relieve fatigue or headache from eye strain, which may often be found helpful and soothing.

MEASURING SIGHT or VISION. See *testing the eyes.*

MEDICINES for the eye. Whereas the eye is often much benefited by the application of various antiseptics and medicines, its structure is of so delicate a nature that a wrong substance may easily aggravate any existing disease or cause additional trouble, even permanent damage. Individual cases require different medicaments under different circumstances, and it is therefore impossible to lay down general rules on this matter. It is the utmost folly ever to think of attempting self-treatment with any of the commercial patent remedies on

the market. They are certain to be useless and may be harmful. The limit of home applications to the eye for mild irritations, etc., should be plain water or normal saline solution, perhaps boric acid solution in some cases. Any condition needing more than this should be in the hands of a doctor and anything else to be put into the eye should be done only as prescribed and directed by him.

See *drugs, "drops," eyewashes, patent medicines,* and *quackery and fraud.*

Metron-O-Scope. A device to aid in the training of correct reading habits. It is a machine holding reading matter printed on a roll of paper (much like a player-piano roll) so screened that only one line, or as little as one-third of a line, may be seen at a time. The roll may be fed through the machine at any desired speed and, by reading the print as it appears at the opening, the subject is helped to form better habits of reading as to speed, concentration on words, etc.

See also *reading* and *Ophthalm-O-Graph.*

MOTHERHOOD and sight. See *pregnancy* and *prenatal care.*

MOVIES and sight. There has been much difference of opinion, even among medical men, as to the effect of moving pictures on the eyes. Years ago when movies were something of a novelty (and incidentally very imperfect—blurred, flickering, jumpy—as compared with the technically finished product of today) there was heated talk against them as a positive source of much eye damage. To some extent this feeling is still current, but on the whole professional opinion is now far more tolerant of them. But there is no denying that movies may well bring about eye strain and, if too regularly attended (some persons go 4 or 5 times weekly) may have an injurious effect upon sight. However, if attendance is kept within reason (not over 2 or 3 times a week), if not too many of the long "bargain" or triple-feature shows are sat through (about 2 hours is a safe average limit), and a few simple precautions are observed, there is ordinarily no reason why this inexpensive form of amusement may not be enjoyed without undue risk to the eyes. The chief danger is, of course, eye strain, resulting

as a rule from too prolonged staring at the screen through interest in the picture, and from the glare and sharp contrast of the brightly illuminated screen and dark house. Training oneself to rest the eyes by looking away from the screen, at the ceiling, or closing the eyes for a few seconds every 10 or 15 minutes will help the first condition, and choosing shows with subdued general house illumination will help the second. Eye strain may result also from position: sitting too far to one side, too close, or too far back may force upon the eyes a too constant effort of accommodation. The solution is to choose one's seat accordingly, and not to attend if the house is too crowded to permit this choice. Finally, if one's eyes normally require glasses, they should be worn at the show (even by girls who think they spoil their appearance with the "date"), and kept well polished so that the light does not create a glare against their dusty surface.

Murine. One of the oldest and most widely advertised of patent eyewashes or lotions. It is still being actively promoted at the present day. Consistency is not one of its advertiser's virtues: some ads recommend one drop in each eye routinely night and morning, others call for two drops; some ads boast of its six ingredients, others of its seven "scientifically blended" ingredients. Actual tests have shown its composition to vary from time to time, but essentially it is a mildly alkaline water solution (practically *all* water) of borax with traces of some alkaloid, perhaps berberin. At times it has also been found to contain a small amount of carbonate. It is alleged to "cleanse and soothe burning, smarting eyes" and to bring "quick, amazing relief to tired, strained eyes," results which such a solution naturally cannot achieve. Its estimated cost of manufacture is about 5c per gallon, but it sells for many times this amount for a tiny one-ounce bottle. In former years the promoters of this product even conducted a "College of Ophthalmology and Otology." Should irritated eyes need a simple wash, normal saline or boric acid solution, or even plain water, will be found to be of as much if not more benefit at little or no cost. Anything more than this should be used only under a doctor's prescription.

See *eyewashes* and *quackery and fraud.*

MUSCAE VOLITANTES. A technical term for *spots before the eyes,* which see.

MUSCLES OF THE EYE. The eye is supplied with two types of muscles the proper functioning of which is necessary for good vision: the internal or intrinsic muscles, and the external or extrinsic muscles. The intrinsic muscles are those within the eyeball itself. There are two sets of these: the ciliary muscle which is a ring of tiny muscle fibers about the capsule containing the crystalline lens, and the little muscle fibers of the diaphragm or iris of the eye. It is by the action of the former that the curvature of the lens is altered so as to keep its focus clear on the retina for seeing at various distances (see *lens of the eye, accommodation,* and *focus);* and by that of the latter that the size of the pupil is varied in inverse accordance with the intensity of light reaching the eye (see *iris).* The external muscles are fastened to the exterior surface of the eyeball and to the eye socket. They are six in number for each eye and are arranged in three sets of two each, so placed that the action of one of each set opposes that of the other. Through these muscles the eyeballs may be moved from side to side, up and down, or given a rotary motion. It is also by means of these muscles that the eyeballs may be moved within their sockets so that both point at the same spot on a close object (see *convergence),* or the gaze shifted from one place to another without moving the head. Disease or injury may produce a paralysis or imbalance in these muscles; the result is that the two eyes will not coördinate as they should, each will point at a different place, and double vision will follow (see *double vision* and *cross-eyes).*

MUSCULAR IMBALANCE. A condition in which one (or more) of the external muscles of the eye (see *muscles of the eye)* does not for some reason properly oppose and balance the tension of its opposite fellow. The eye will in consequence not coördinate with the other and point with it to the same spot in the visual field. Thus, each eye points at a somewhat different spot; the result is double vision and, in more extreme cases, noticeable crossing or divergence of the eyes. See *cross-eyes* and *double vision.*

MYDRIASIS. Excessive dilation of the pupil of the eye, either as a result of disease, spasm, or other morbid condition, or from the administration of certain drugs, as the *cycloplegics*, which see.

MYODISC LENSES. A special type of concave lens sometimes used for extreme degrees of myopia or nearsightedness to achieve a better appearance with the glasses than would be possible with lenses of the customary design; the latter would have to be abnormally thick at the edge and clumsy looking in order to have the requisite optical power. In this lens only the central portion has optical power and is ground to the same prescription as would be the case with an ordinary lens; the surrounding glass acts merely as a support for holding the central portion in the spectacle frame. Naturally, such a lens limits the range of vision, but this usually makes little difference since the great majority of seeing is done straight ahead through the central part of whatever lens may be in use.

See also *lenses* and *glasses*.

MYOPIA. Nearsightedness, which see.

National Society for the Prevention of Blindness. This worthy organization started in a small way as a municipal movement in New York City back in 1908 under the leadership of Miss Louisa Lee Schuyler. Its primary purpose was the dissemination of knowledge of Dr. Crédé's discovery of the power of a few drops of silver nitrate solution as an almost certain preventive of infant blindness from birth infection of the eyes. Its work, however, gradually enlarged beyond the confines of the city, and in 1915 the organization became a national one. From its start, it has been unfailing and untiring in fulfilling its avowed purpose, namely, "to prevent blindness and save sight." Much of its best work has been in protecting the eyes of school children. It coördinates the work of professional groups, the latest scientific discoveries concerning vision, and the means of popular education to spread as widely as possible all information that may be of value in the preservation of the individual's and the nation's sight. Much of the interest in the present "conservation of sight" movement is due to its efforts. It holds itself ready at all times

to supply authoritative information on request on the various aspects of blindness and vision defects and their prevention and remedy. Any person desiring such data may address the Society at its headquarters at 50 West 50th Street, New York City.

See also *conservation of sight.*

Natural Eyesight Institute. See under *Normalizer.*

"NATURAL METHODS" of sight correction. A euphemism under which the "Sight Without Glasses" racket—systems of exercises, massage, etc.—sometimes hides. See *"Sight Without Glasses," exercise,* and *quackery and fraud.*

NEARSIGHTEDNESS. This refractive defect of the eye, known technically as myopia, is a result of a malformation of the eyeball which makes it longer than normal from front to back. Thus the distance between the crystalline lens and the retina is longer than the focal length of the lens, so that the clear image refracted by the lens is focused in front of the retina, and the image that falls on the retina (and is transmitted to the brain) is blurred and imperfect, as is the visual impression it gives rise to. When very close objects are looked at, the light rays reaching the eye from them are divergent (whereas those from distant objects are practically parallel), the image is focused farther from the lens, and the image falling on the retina is clearer as the object is closer to the eye, until in some instances vision at 18-20 inches may be nearly perfect; hence the designation "nearsightedness." Naturally, distant vision is extremely blurred and indistinct, only general outlines as a rule being distinguishable; a nearsighted person may not be able to recognize a friend across a room.

Nearsightedness differs from farsightedness in a special way: the farsighted eye may in cases of slight defect be able through a strained effort of the power of accommodation to compensate fairly well and get reasonably clear vision (though at the cost of eye strain); but the nature of the mechanism of accommodation does not permit it to do the opposite and make any compensation for nearsightedness (see *accommodation* and *farsightedness).* Consequently, nearsightedness of

both small and large degree must be corrected by glasses if good vision is to be enjoyed.

Nearsightedness may be congenital or acquired. In the former the conditions governing the elongation of the eyeball are present from birth and the defect may or may not get worse as time goes on. The acquired form may affect either a previously normal or a farsighted eye. Just what causes this type of myopia is at present not clearly understood. Poor posture, inadequate lighting, deficient diet (especially in vitamins), failure to wear glasses when needed, the attempt of the eyes to meet the demands of civilization—these are a few of the factors that have been suggested as causes; possibly all play some part under various circumstances. There may also be in all cases some degree of hereditary predisposition. One thing is certain: there is more myopia found among persons doing continuous close and finely detailed work (scholars who read and write long hours each day, seamstresses, watchmakers, engravers, etc.) than among any other class. Thus it appears likely that the strain of using the eyes for prolonged close work is a powerful factor in bringing on this impairment. Regular and unfailing resting of the eyes would do much to offset this (see *resting the eyes*). It further appears that when the close work is done in improper or insufficient light the tendency to myopia is increased; hence, correct illumination is always a wise protective measure (see *lighting*).

The only satisfactory remedy for the great majority of cases of nearsightedness is properly fitted glasses. This is necessary not only to relieve the discomfort and inefficiency under which the myopic person otherwise labors, but also as a preventive measure: for if uncorrected it may (particularly if close work is continued in) constantly get worse, sometimes even ending in blindness. This is especially important with nearsighted children, because with them the tendency for the uncorrected defect to increase is most marked. Similarly, nearsighted persons should have their glasses checked regularly, for wrong glasses can be almost as bad as no glasses at all.

Correction is simply a matter of placing before the eyes concave lenses (thin in the middle, thick at the edge) of suitable power. This means suitable for *each* eye, for rarely is the defect the same in both eyes. The concave lens spreads the

incoming parallel light rays from distant objects and presents them to the eye divergent as if coming from a close object. This type of rays the accommodation of the eye can then manage and achieve a clear focus on the retina (see *focus, lenses,* and *glasses).*

The above refers largely to the commonest type of nearsightedness, known as "simple" myopia, in which there is merely elongation of the eyeball from some cause, and resultant blurred sight. This variety may become a little worse as time goes on or close work is continued, but on the whole does not do so rapidly. Indeed, in some cases it may get less after middle life since at that age it is the natural tendency for the eye to become farsighted (see *presbyopia);* the one defect may work to offset the other and lead to more nearly normal sight. (It is futile, however, for nearsighted persons to expect excellent sight after forty-five because this occurs rarely.)

There is another type of nearsightedness called "progressive" myopia which is far more serious than the other. In this type the rear wall of the eyeball becomes (for reasons as yet not well understood) congested, softened, and weakens and gradually stretches, making the eyeball longer and longer, and the nearsightedness progressively worse and worse. This increase is usually most rapid before the age of 30 and not so much after. If this process is allowed to continue unchecked the retina may finally become detached and blindness will follow. Myopic persons who require too frequent change of glasses (every few months or so), and who still do not seem to enjoy comfortable vision, should suspect this disease and consult an oculist *immediately* for examination. For *prompt* treatment can usually halt the progress of this disorder, whereas if it is permitted to go too far there is little that can be done in the majority of cases to save sight. There has been some scattered success in the re-attachment of detached retinas, but this operation is as yet far from a reliable one. There has been more success in halting this ailment by the removal of the crystalline lens (and the fitting of suitable glasses to replace it, as with cataract) but this too has its dangers and is far from universally applicable. Few general rules can be drawn to cover this disorder, each case to a large extent having

its individual characteristics that can be determined only on examination by an experienced, trained oculist, and only the best should be consulted for this trouble. However, this much may be said to all sufferers from progressive myopia: all close work (reading, writing, sewing, etc.) must be cut down to its very minimum, if not entirely discontinued; there should be no heavy lifting, and there should be no strenuous activities or sports (as distance running, diving, tennis, etc.). These precautions are especially necessary when the victim is still in his adolescence.

See also *care of the eyes.*

NERVES OF THE EYES. To obtain a single clear image calls for the properly coördinated action of all the muscles of the eyes, internal and external (see *muscles of the eye),* so that the eyes focus correctly and both point to the same spot (see *accommodation* and *convergence).* To accomplish this requires nerves to motivate and govern the process. Vision being ultimately a sensation or impression rather than a physical or material thing, nerves again are needed to bring about this sensory reaction to the stimulation of the light rays.

The nervous system of the human sight apparatus is as complex as that of any other organ of the body, and is the most complicated portion of the whole seeing mechanism. It divides into two general parts, according to the major function performed: sensory and motor.

The sensory nerves are those that react to the incoming light rays. These have their light-sensitive endings in the rods and cones of the retina of each eye (see *retina* and *visual purple),* and the impulses they pick up are transmitted over a multitude of tiny nerve fibers that all come together to form the large trunk of the optic nerve. The latter passes from the rear of the eyeball (at the so-called "blind spot"), through a fissure in the back of the bony socket, and on up to the visual centers of the brain. There the nerves coming from both eyes are so inter-connected that (if the eyes are normal) the brain centers are able to "fuse" the nervous responses from the separate and slightly different images of the two eyes into a single visual impression having depth or perspective (see *fusion).*

The motor portion of the visual nervous system consists of nerve centers in the brain which have nervous connections with the sensory centers. From these run efferent nerve fibers to the various muscles of the eyes: to the six external muscles of each eye, to the ciliary muscle within the eye controlling the shape of the crystalline lens, and to the muscle fibers in the iris that regulate the size of the pupil. Light rays enter the eyes and strike the retinas; the rods and cones send impulses to the sensory sight centers in the brain; if the resultant sensation is not a single, clear, comfortable impression of the object looked at, the sensory centers in order to gain such an impression send corrective impulses to the motor centers. These in turn distribute appropriate impulses through their many fibers to the muscles of the eyes which prompt them to act in order to obtain this desired correction: to the external eyeball muscles to so converge the eyes as to point to the same spot and get a single image; to the ciliary muscles to so bulge or flatten the crystalline lenses as to get sharp focus and clear images on the retinas; and to the muscles of the irises to make the pupils larger or smaller and admit more or less light for better vision and comfort. This interaction between the sensory and motor nerves continues until a single, clear visual impression is obtained (unless some deformity, disorder, or external lack—as improper illumination—makes this physically impossible, in which event there will be defective vision or eye strain, or both), and comes back into play whenever circumstances change and demand a readjustment.

See also *eye* and *sight*.

NIGHT BLINDNESS. The person afflicted with this disorder is unable to see in dim illumination, or to see as well as he normally should in such light. He may see quite clearly in daylight, but be able to see little or nothing in twilight when others are still getting about without trouble. Often such a person may be temporarily blinded by bright light also. Vision in daylight may be normal, and glasses are often not required.

Night blindness is not a trifling handicap, for the person who suffers from it suffers all the disadvantages of blindness

or very poor sight. One survey showed that in 62% of night automobile accidents the drivers had night blindness.

The commonest cause is generally held to be a deficiency of vitamin A in one's diet. This undoubtedly is a factor since the administration of vitamin A tends to relieve it in most cases. Extra vitamin A may be had either from the concentrated vitamin pills now available, or by revising one's diet to include items that are rich in this vitamin: butter, eggs, carrots, tomatoes, celery, lettuce, cantaloupe, pineapple, oysters, etc. Cod-liver oil contains an exceptional amount of vitamin A.

Night blindness may also be the result of psychological factors. It has been found in soldiers having an adequate diet, as a consequence of shock, fear, etc. (see *emotion and sight*). Mental stress and worry may bring it on temporarily, as may prolonged exposure to glare. There appear to be some instances of an hereditary form in which no alteration of the retina can be noted, but this is comparatively rare. Its most serious form is as a symptom of a grave disease of the retina, retinitis pigmentosa, which may readily lead to blindness unless promptly treated. By examining the interior of the eye an oculist can note early signs of this disease and take precautions accordingly; hence, any one finding himself suffering from night blindness will do well to visit an oculist at once for a thorough examination, just to make certain that if retinitis should happen to be the cause it can be taken care of properly.

See also *day blindness*.

Normalizer. A quack gadget put out by the "Natural Eyesight Institute" of Los Angeles, California, and sold to gullible spectacle wearers along with a "system" of so-called exercises and manipulations on the claim that it would enable them to throw their glasses away and "get rid of the spectacle handicap." Use of the "Natural Eye Normalizer" (its full title) was advertised without reservation to "make it easy to correct Nearsight, Farsight, Astigmatism, Eyestrain, Weak Eyes, Failing Vision, Old Age Sight, Muscle Trouble, etc., at home without glasses." Indeed, there appeared to be little in the

entire field of vision impairment that its enthusiastic promoter did not assert would yield to it. The contrivance was simply a small box-like mechanism having two rubber-lined eye cups projecting from one side, the distance between them being adjustable by a knob at one end, and having three levers projecting from the opposite side; the manipulation of the levers imparted a quarter-turn rotary motion backward and forward to the cups. To use it, the cups were merely to be pressed against the closed eyes and the levers operated; this was supposed to result in the eyes being "gently rotated" and their muscles "gently stretched and relaxed," and end by restoring normal sight. Actually, all the gadget did was to twist the eyelids about a bit. This racket brought its backers a considerable income for years. Fortunately, the Post Office Department finally took action, and this business is now barred from the mails. This fraud formed but one of the many aspects of the "Sight Without Glasses" quackery.

See also *"Sight Without Glasses," exercise,* and *quackery and fraud.*

NORMAL SALINE SOLUTION. This is easily prepared by dissolving two teaspoonfuls of ordinary table salt in a quart of boiling water, allowing to cool and settle, and carefully pouring off the clear liquid from any sediment that may fall to the bottom. This is frequently recommended as best and safest for a routine eyewash to be used at home for mild inflammation or irritation, dust in the eye, etc. It is preferred by many doctors to the formerly popular boric acid solution. As its composition approximates that of nature's own eyewash, tears, its use is likely to be attended with the least possible danger of any lotion. Should the eyes require anything more than this, it should be used only as prescribed by a physician.

See also *eyewashes* and *washing the eyes.*

NORMAL SIGHT or VISION. There is much reference made to "normal" and "perfect" sight, but the truth is that there are surprisingly few strictly normal eyes and consequently very little completely normal vision. Sometime during their development most eyeballs become a bit too long or short, the corneal surface becomes distorted, the muscles become a little out of balance, or the like; then follows a comparable

deviation from normal sight which must be corrected by glasses or other means if anything like normal vision is to be enjoyed. In addition, one eye is often better than the other and does more. What we today consider "normal" sight (the ability not only to follow a ball across the golf links, but also to spend long hours reading fine print, adding columns of figures, etc.) is not what nature had in mind for his eyes when she planned man—mainly alert, sturdy eyes that could spend the daylight hours looking into the distance for danger and prey without especial strain or effort, and the dark hours closed in restorative sleep. The constant effort of civilized man to force his concept of "normal" to replace nature's has been too much for the eyes, and their rebellion has taken the shape of the multitude of visual defects we find everywhere today (see *defective sight*).

Normal vision as we understand it today means first of all the ability to see clearly at a distance as well as for close work (14-20 inches) and at all points between, without undue eye strain. At distances greater than 20 feet, the normal eye should see clearly without any effort or strain at all, if illumination is not too little or great. The acuity of normal vision, the fineness of detail it is able to distinguish at a given distance, has been set somewhat arbitrarily, but reasonably, at one geometrical minute of arc. For an eye to see a small object or detail as a single thing, it must be able to distinguish its top limit from its bottom and its one side limit from the other. This means that the light rays coming from the extreme limits of top and bottom of the object meet at an angle at the eye, called the "visual angle." If a given object is moved farther from the eye, this angle becomes less; if closer, greater. If at a given distance a larger object is substituted, this angle becomes greater; if a smaller, less. Thus it may be comprehended that it requires the same acuteness of vision to see, say, a one-inch ball at 30 feet as a two-inch ball at 60 feet, all other conditions being equal. It has been deduced from many tests and observations that the smallest visual angle that can be distinguished by the normal eye is one of one minute (1/60 of a degree or 1/21600 of a complete circle); anything less than this usually tends to blur with its surroundings. There are eyes, however, that are keener than this "normal."

This standard is made use of in the regulation Snellen Chart for testing visual acuity. This chart is filled with lines of letters, each line smaller than the above and marked with the number of feet at which the normal eye should be able to read that line and all above it. These letters are so calculated that their details or thickness of their lines (*not* the over-all letter) give a visual angle of one minute at the indicated distance. The standard test distance being 20 feet, the normal eye should just be able to read the 20-foot line and all above it without too great strain, and its visual acuity would be rated at 20/20, or normal. Should the eye (each is tested separately) be able to read nothing below, say, the 40-foot line, its acuity would be 20/40 (20 being for the test distance and 40 for the line that should be read at 40 feet but can only be read at 20 feet); this is to say that this eye must come within 20 feet to see what it should at 40 feet, and is consequently defective. Should the eye be able to read the 10-foot line, its acuity would be 20/10 and it would be much better than normal. For ordinary purposes the range of normal visual acuity is generally taken as from 20/30 to 20/15.

In more common terms, the normal eye should be able to read printed letters 3/8 inch high with strokes about 1/16 inch thick at 20 feet under good illumination.

See also *testing the eyes, eye,* and *sight.*

Nos-ease. A patent device consisting of small, soft pads that slip over the nose supports of spectacles to relieve rubbing and irritation. Properly fitted glasses should be comfortable and not require such aids. Also, frames may be obtained with plastic nose-pads which are smoother and less irritant than metal ones. However, persons who are sensitive to the pressure of glasses on their nose will find these attachments of benefit.

See also *Ear-ease* and *wearing glasses.*

NYSTAGMUS. A condition under which the eyeballs undergo continued rapid oscillation within their sockets. The movements are short and quick (the eyeballs seem sometimes to "shake" in their sockets); they are involuntary and not to be confused with the ordinary movements of seeing, and are usually from side to side, but may be up and down, rotary,

or mixed. This disorder may be present from birth, may follow birth infections of the eyes, or may be the result of some abnormality of structure of the eye. It is often found in albinos. It may come on in later life as a result of disease of the inner ear, some disorder of the central nervous system, poisoning by certain drugs, etc. It also occurs in an occupational form which seems mainly to follow prolonged working in awkward positions before dark surfaces without sufficient general illumination; coal miners are particularly susceptible to this variety, which is consequently usually referred to as "miners' nystagmus." Better working conditions and more illumination will do much to prevent this. Both eyes are usually affected by nystagmus and the sufferer is ordinarily quite unconscious of the movements, which are very persistent and cease only during sleep. Adequate treatment, the earlier the better, can do much to correct this disorder.

OCCUPATION AND SIGHT. See *industry and sight.*

OCULIST. A person who has graduated from an accepted medical school, fulfilled all the requirements for a practicing physician, and specializes in the diagnosis and treatment of the eye, its defects, disorders, diseases, and injuries. He is also known as an *ophthalmologist.* He is the true "eye doctor" or "eye physician." The oculist is distinguished from the optician who grinds lenses to prescription, fits them to spectacle frames, repairs frames, etc., and from the optometrist who is trained merely to measure the optical defects of the eyes and prescribe or fit glasses to them. He is the only one of the three who is trained to detect the symptoms, especially the important early symptoms, of the many ailments and diseases the eye is subject to, and the only one of the three permitted by law to give whatever medical or surgical treatment may be necessary (see *diseases of the eyes).* Only the oculist is permitted by law to carry out a complete examination of the eye, since this requires the administration of "drops" to dilate the pupil (see *cycloplegics),* whereas neither the optometrist nor the optician is allowed to administer medicaments of any sort (see *examining the eyes).* Therefore, it is wisest to go to an oculist even when it appears that only glasses are needed, for not only can he measure the eyes for glasses as well as the

others, but he can do a more thorough job with "drops" and at the same time note any diseases of the eye, actual or potential, and institute treatment before they reach serious proportions (see *buying glasses).* The term "oculist" is occasionally loosely applied by the public to spectacle fitters and even grinders as well as to eye doctors, but such usage is wholly erroneous. There are about 6000-8000 oculists in this country at present, but only some 2000 of them have been certificated by the American Board of Ophthalmology.

OINTMENTS for the eyes. See under *patent medicines.*

"OLD AGE SIGHT." See *presbyopia* and *age and sight.*

OPERATIONS, surgical, on the eye. It is only natural that surgery practiced on an organ as delicate and complex as the human eye should be fraught with danger of failure. But the past generation has witnessed such amazing advances in the field of optical surgery that many conditions, which were formerly considered hopeless and certain to lead to blindness, can now be treated by the eye surgeon with a better than even chance of success. Naturally, there are some popular misconceptions concerning eye surgery, as for example the belief that eyes may readily be transplanted. While there has been some success in the transplanting of eyes in the lower animals, eye transplantation in human beings offers numerous difficulties (not least of which is the obtaining of a healthy eye for the purpose) that make it questionable whether this operation will ever be commonly performed. However, the operation (keratoplasty) for transplanting clear corneas to replace opaque or scarred ones and thus restore sight is now performed with a good percentage of success. And the outlook of a condition which 30 years ago was considered almost certain blindness for life, namely, detachment of the retina from the wall of the eyeball, was changed in 1929 when Gonin contrived an operation for its re-attachment; today surgeons report a success in this field of from 28%-83%. Removal of the crystalline lens to counteract cataract, and in some cases progressive myopia, has become an accepted part of eye surgery, and its technique is constantly being perfected. Glaucoma, which once inevitably lead to blindness, can now be

arrested by surgery (when drugs prove inadequate) in an encouraging number of instances. Operations to straighten crossed eyes have long been known, but they are becoming more accurate and dependable than the hit-or-miss methods practiced years ago. Even drooping eyelids are now rectified by suturing an unparalyzed eyeball muscle in the lid. To be sure, eye surgery is still accompanied by many hazards, and it should not as a rule be resorted to when any other reasonable remedy offers, but when necessary it may now be undergone in desperate cases without undue misgivings. And there can be no doubt that the years to come will see further amazing advances in this field.

OPHTHALMIA. A general term for any severe inflammatory condition of the eye or conjunctiva. It occurs in many varieties and from many different causes. See also *conjunctivitis* and *diseases of the eye.*

OPHTHALMIA NEONATORUM. An inflammatory condition of the eyes of newborn babies. It usually appears on or before the fifth day after birth and starts as a redness and swelling of the lids accompanied by discharge from the eyes. The redness and swelling increase until after several days the lids can scarcely be opened and the discharge bcomes thick and copious. This discharge is infectious and, should it get into the eyes of adults or older children, it will cause an even graver inflammation there. The baby's eyes become infected as a rule during its passage through the birth canal of an infected mother, but they may also pick up the infection later from a nurse, soiled towels or linen, etc. The commonest infection producing this inflammation is gonorrhea; this accounts for about 60% of all cases, the rest of them resulting from other types of bacteria. Unless promptly and adequately checked, this disease will scar and corrode the cornea and end in blindness. An almost absolutely certain preventive is the introduction into each of the baby's eyes of a few drops of silver nitrate solution immediately after birth; this should not be neglected, and many states have laws compelling the attending doctor or midwife to do it. Whereas formerly this disease was held accountable for 28% of all blindness in this country,

this precaution had by 1934 reduced it to 5%, and additional care can reduce it still further.

See also *baby's eyes.*

Ophthalm-O-Graph. A machine that analyzes a person's reading habits so that proper corrective training may be instituted for more efficient reading. It makes a photographic record of the movements gone through by the eyes in reading—how fast or slowly they move, how often they stop or go back to re-read words, etc. This record may then be studied at leisure by experts and measures taken accordingly.

See also *reading* and *Metron-O-Scope.*

OPHTHALMOLOGIST. Another term for an *oculist,* which see.

OPHTHALMOSCOPE. An instrument for examining the interior of the eye, the retina in particular. It consists essentially of a concave mirror with a small hole through its center. This mirror is so held before the eye to be examined that light (either from a source behind the patient's head or from a tiny electric bulb in the handle of the instrument) is reflected from it through the pupil into the eyeball; the examiner, by looking through the hole, may see inside the eye. This is necessary for any really complete examination of the eye, and through it the early symptoms of many serious eye diseases (and even of general bodily diseases) may be detected.

See *examining the eyes.*

OPTICAL ILLUSIONS. A general term for examples that illustrate the innate oddity of vision by which one seems to see things differently from what they actually are. One of the commonest cases is when one is seated in a moving train: the telegraph poles often seem to be moving backward past the window instead of one's moving past the poles, or when another train passes close to one's own while it is standing still, the second train will frequently appear to be stationary while one's own is moving. Perspective in pictures is another illustration, which by suitable proportion in dimensions gives the sense of depth or distance though all the lines are known to be on a perfectly flat surface. A great number of

sketches and diagrams demonstrate this phenomenon: representations of equal height and width but so drawn that one appears greater than the other; straight lines crossed with a series of curved or crooked lines so that the straight lines falsely seem bent; the familiar pile of shaded cubes the faces of which may seem to be going inward or outward according as they are concentrated upon; the similar line drawing of a staircase which can be seen as upright or upside down depending upon how the attention is fixed upon it; parallel lines crossed by a number of zigzag lines and consequently made to look not parallel; and many, many more.

These illusions are due mainly to the fact that vision as we know it is by no means simply a physical and physiological process of light transmission and refraction and nerve stimulation. These factors play an indispensable part in seeing, it is true, but they merely furnish what may be termed the "raw materials" of vision. The visual centers of the brain take, combine, and *interpret* in the light of associations, habit, past experience, and to a large extent what the mind already expects or presumes to be present before the thing in question is even looked at. The lines, forms, colors, textures, etc., brought to these centers by the eyes and nerves (which otherwise would appear merely as a conglomeration of those lines, forms, etc., without meaning, as they probably do to a very young child who has not yet "learned" to see), are molded by them into a visual impression of a meaningful whole. This does not of necessity correspond entirely and exactly with the objective facts if the situation is such as to permit the interpretative elements in the mind to alter them.

After images and the phenomena they give rise to (as the commonest one of seeing the rapid series of separate pictures that make up a movie as smooth, continuous motion) are often loosely referred to as optical illusions. Perhaps in a sense they are, for they too involve an element of interpretation; but strictly they are not, since basically they are the result of the chemical action of the retina in seeing (see *after images*).

See also *sight*.

OPTICAL NERVES. See *nerves of the eyes*.

OPTIC DISC. The point of entry into the retina of the optic nerve. It is more commonly known as the *blind spot* of the eye (which see), for there are no light-sensitive nerve endings there and no vision at that spot. The condition of this disc tells the experienced oculist much about the state of health or disease of the eye.

OPTICIAN. A person trained and equipped to grind lenses according to the prescription of the oculist or optometrist who tested the eyes for which they are intended, to fit them into frames, and to adjust the spectacles to the face of the wearer. A true optician does no testing of the eyes for glasses or treating of the eyes for disease. He is thus distinguished from the oculist, who may do both, and from the optometrist, who may do only the former. Many optometrists and some oculists combine part or all of the functions of the optician with their own profession.

See also *oculist, optometrist, examining the eyes,* and *buying glasses.*

OPTIC NERVE. The trunk or "bundle" of innumerable nerve fibers running from the rear of the eyeball (at the *blind spot,* which see), through a fissure in the back of the bony eye socket, to the brain. It is made up of the many tiny nerve fibers that spread out through the retina to connect with the millions of light-sensitive nerve-endings there, the rods and cones. Within this trunk there are also the blood vessels that supply and nourish the eye.

See also *nerves of the eye, eye, retina,* and *sight.*

OPTOMETRIST. A person who is trained to test the vision of eyes, measure the kind and degree of their visual deficiencies, and prescribe and fit glasses to correct them. The University of the State of New York, which licenses every optometrist in that state, defines him as one who "by means or methods other than the use of drugs diagnoses any optical deficiency or deformity, visual or muscular anomaly of the human eye, or prescribes, provides, furnishes or adapts lenses, prisms, or ocular exercises for the aid, correction or relief of the same, or who holds himself out as being able to do so."

The optometrist, then, is merely a technician, a lens-fitter

or a "glasses doctor," so to speak, and is not a true "eye doctor" at all, as is the oculist. He has had no formal medical training and holds no medical degree or license; he is consequently not permitted by law to treat any disease, disorder, or injury of the eye by medicine or surgery, or to use on the eye any drugs for any purpose, including that of examination. This limits his usefulness considerably, for a very important feature of an eye examination, even when primarily to determine the glasses needed, is to discover the first signs of any serious eye ailments (see *diseases of the eye)* and institute prompt and effective treatment to counteract them. The optometrist is not trained to recognize such symptoms nor is he fitted or allowed to treat them if noted. Further, he cannot even carry through the complete examination which often is necessary to reveal these symptoms, as such an examination usually requires the administration of "drops" or drugs in the eye to dilate the pupil (see *cycloplegics),* and he is not licensed by law to utilize drugs for any purpose.

It is perfectly true that a well-trained, ethical optometrist may serve just as well as an oculist, *if only glasses are required,* and perhaps even better since he is likely to have better equipment and more experience in refraction than the oculist of more general practice. But when it is remembered that about one out of ten who go to an optometrist has, in addition to optical defects, some pathological eye condition that demands medical or surgical attention, it is apparent that the average person runs about a 10% chance of insufficient care. Of course, the optometrist could note any symptoms of disease and send the patient to a specialist, and the reputable ones will do this; but his training is not such as to enable him to discover the more subtle or the incipient cases, conscientiously as he may try; whereas the irresponsible practitioners will not even bother to look for the symptoms, being interested solely in selling the most expensive set of spectacles possible.

Optometry, then, is a respectable profession, the worst hazards of which lie in its limitations. However, another danger has in recent years given the profession a black eye, and that is the great number of unscrupulous optometrists who have entered the profession. These unethical practitioners try to sell as expensive glasses as possible to all who come into

their shops, whether or not they need them, and with not too much regard for their correctness if they do need them. This condition has led to exposes of the abuses of optometry in various newspapers and magazines. Investigators with perfect sight have visited numerous optometrists and have been sold unneeded glasses by many of them. A strong element in this evil is the fact that most optometrists not only test the eyes but also sell the lenses and glasses right in the same shop, and it is in this feature that their profits lie, the examination often being "free." The ethical optometrist would be more likely to charge for his examination, and give a prescription for lenses which could be taken to an optician, as the oculist usually does. Of course, these fraudulent operators are deplored by no one more than by the ethical optometrists who are doing everything in their power to drive them from the field with increased training requirements, stricter licensing laws, etc.

The optometrist frequently makes counter-charges of unethical practices against the oculist—"kick-backs" from the optician to whom he sends the patients for his lenses, percentages on the frames purchased, etc. These accusations contain much truth and the medical profession is doing its best to eliminate such customs. But though unfair practices exist on both sides, the optometrists present lesser potential advantages to the spectacle-buying public. Apart from the basic limitations of the optometrist, he is far more likely to be consulted by the average person through his high-pressure advertising policies and conspicuous shopfront establishments than is the oculist with his unobtrusive office and ethical prohibition against advertising. Further, the smaller number of oculists increases the likelihood of choice of an optometrist. It is estimated that there are about 14,000 optometrists practicing in the United States as against only 6,000-8,000 oculists. This feature is further borne out by the estimate that about three-quarters of all the glasses worn in this country are furnished by optometrists.

It is thus to be recommended on the whole that any one needing attention for his eyes runs less chance of overpaying and incompetence with an oculist than with an optometrist,

and that whether one or the other is chosen care should be taken to assure his reliability and fair price practices.

See also *buying glasses, examining the eyes, oculist,* and *optician.*

ORTHOPTICS. A class of eye exercises or regulated and prompted eyeball movements intended to train and strengthen certain of the external eye muscles (see *muscles of the eyes),* and to correct, or at least better, their deficiencies, imbalances, etc. This is the one and only portion of the whole field of eye "exercise," most of which is exploited by quacks, that is recognized by reputable medicine as of any benefit. Its value, of course, is limited solely to those visual defects originating in some disorder or incoördination of the eye muscles (which means mainly some form of double vision, or the eye strain occasioned by the effort to achieve single vision). Exercise will *not* improve bad vision from refractive defects, as the "Sight Without Glasses" quacks claim.

Though the means and instruments for achieving it vary, the purpose of orthoptics is simply the training of the external eye muscles so that they move both eyeballs to point or converge on the same spot in the visual field, and thus enable the brain to "fuse" the images from the two eyes into a single visual impression (see *convergence* and *fusion).* It has much use in the straightening of cross-eyes. The instruments differ somewhat in form, but fundamentally they are variations of the old parlor stereoscope through which people used to look at double pictures of popular scenes which appeared as a single picture with the illusion of depth or perspective. The orthoptic instruments employ this same principle: they have lenses through which each eye looks at a different picture, the two of which put together will make a whole. Thus one eye may see a cage and the other a bird, which when properly combined has the bird in the cage; or one eye may see a fence and the other a chicken, which when properly fused by the visual centers is seen as a chicken sitting on the fence. The imbalanced eyes look through the instrument and attempt to see or fuse the two pictures as one; and the effort of so doing constitutes a form of muscular exercise which gradually trains the eye muscles to converge correctly. Should the imbalance

be too great to permit of fusion even with the greatest effort, the lenses in the instrument may be so adjusted as to cut down the discrepancy to the point where the eyes are capable of making up the difference, and as the eyes improve this lens-setting is modified. The person merely sits at this instrument and brings the images into fusion, holds them there for a moment until they fall out of fusion again, and brings them back in again; he repeats this for a period of time (20-30 minutes or until weary), several times weekly, or daily in some cases, not neglecting to rest the eyes frequently. This regulated movement gradually trains the eye muscles in their duty, much as exercise or gymnastics will do for any muscle of the body.

See also *exercises, cross-eyes, double vision, muscular imbalance,* and *"Sight Without Glasses."*

OX-EYE. A common term for *buphthalmos,* which see.

PAIN IN THE EYE. This is a symptom that should not be ignored for it may be indicative of a variety of disorders and disturbances, all of which, though of different degrees of gravity, require attention and some of which if neglected may lead to serious consequences. It may be the result of eye strain from glare or from an uncorrected refractive defect, in particular farsightedness or astigmatism; its remedy then would be suitable glasses (see *glasses).* Practically all inflammatory conditions of the eye have some pain of the eyes associated with them, and these call for careful treatment by a competent physician. But the pain may also indicate some deep-seated disease of the eye, as iritis, cyclitis, glaucoma, etc., in which event the outlook is much graver, and prompt treatment is necessary to insure the preservation of sight. Sometimes the eye pain is associated with headache, digestive upset, or some general bodily illness. In any event, when there is pain in the eye that endures for any length of time, an oculist should be consulted for a thorough examination to determine its cause and to take remedial measures.

PALMING. One of the features of most of the exercise systems for sight improvement in the "sight without glasses" racket. Essentially it consists simply of holding the hands over

the eyes for a period of time, but most quacks dignify it as a complex procedure which must be performed just right: one should sit before a table on which to rest his elbows; the hands should be cupped so that they put no pressure on the eyes when over them; the fingers of the one hand should cross those of the other at an angle so that when they are placed over the closed eyes they fit snugly all around them and over the bridge of the nose and exclude all light. Meanwhile, one is to relax completely, dispel all worry and distress from the mind, and try to "think black." The reward for this is supposed to be most beneficial relaxation not only for the eyes but for the body and mind as well. The leader of this type of quackery, Dr. Bates (see *Bates),* quite soberly reports the case history of a 70-year-old man who was losing his sight through a cataract and came to him and was instructed in this art. In his enthusiasm the old man went home and "palmed" 20 hours at a stretch and, lo! the next morning the cataract had begun to disappear; it finally disappeared completely on further palming!

There is no denying that relaxation is not only beneficial but even necessary for the eyes (see *resting the eyes),* but that this hocus-pocus method of resting them holds any special merit is too preposterous even to discuss. Should any one obtain any special comfort from it, palming will certainly do the eyes no harm and will achieve the purpose of resting them; but should any one expect it to cure a refractive defect or eliminate a cataract he is in for an inevitable disappointment.

See also *"Sight Without Glasses"* and *exercise.*

PARTICLES IN THE EYE. See *foreign bodies in the eye.*

PATENT MEDICINES for the eyes. One of the most pernicious branches of quackery in any field are the patent remedies and medicines put out for the self-treatment of the disorders in that field, and the dangers are particularly serious when they concern the eyes. The patent washes, lotions, salves, ointments, etc., may often be nothing more than harmless mixtures of cheap, inert materials elegantly boxed and absurdly over-priced. In such cases the chief damage done is

the waste of money and time that had better been expended in effective treatment, though in some instances they may do greater harm through the delay occasioned in seeking competent treatment. But the worst patent remedies are those containing ingredients that may cause irritation, inflammation, or even permanent impairment. The eye is so complex an organism and the disorders that attack it are so varied and subject to so many altering conditions that one case of eye trouble is seldom exactly like another; each case must be diagnosed and treated according to its individual characteristics; hence, it is obviously impossible to compound medicines for the blanket treatment of a great number of cases. The only wise and safe course is strictly to avoid all commercial preparations for the eyes, from eyewashes and "soothing" lotions to eye cosmetics and salves for "drawing" styes. Any eye trouble that calls for more than simple washing with plain water or normal saline solution is a matter for the physician or oculist, since correct diagnosis of the ailment is necessary before treatment can be started.

See also *medicines, eyewashes, beautifying the eyes,* and *quackery and fraud.*

PERSPECTIVE. That quality of vision which permits judgment of depth or distance and the position of objects relative to the observer and to each other. The chief elements contributing to the formation of this estimate are the apparent convergence of parallel lines that extend away from one (as for example railroad tracks) and the apparent decrease in size of a given object as it is withdrawn from the observer; this data the brain automatically interprets in terms of its experience. The binocular effect of the two eyes aids this judgment considerably and gives the perception of depth to individual objects.

See "binocular effect" under *sight.*

Petit's Eye Salve. A salve supposed to "soothe" irritations of the eye. Its active agent being morphine, it would be likely to relieve pain temporarily, not through effecting any cure, but simply by rendering the eye insensitive for a time. Natu-

rally, no one should put morphine into his eye in this haphazard fashion; if used at all it should be only under the advice and direction of a physician.

See also *patent medicines* and *quackery and fraud.*

Phantom Brow. A patent eyelash dye that has been condemned as dangerous to use because it contains ingredients which, should they get into the eye, may cause damage to it and perhaps impairment of vision. See *beautifying the eyes* and *quackery and fraud.*

PHOTOPHOBIA. A condition in which the eyes are abnormally sensitive to light, even of ordinary intensities, often to the point of pain. The eyes blink and tend to close tightly at their approach to light. This is a common symptom of ulcer of the cornea. It is a matter for expert treatment by an oculist.

Pike Electric Reader. A device for aiding persons with badly deficient sight in reading small print or seeing fine detail. It consists simply of a large hand lens or reading glass supplied with a small electric bulb (lighted either by batteries in the handle or by a plug-in cord for house current) so situated and shaded as to throw its light directly upon the matter being examined and thus insuring ample illumination of it. The ordinary hand lens often blocks off part of the regular light. See also *magnifiers.*

PINGUECULA. A small, yellowish, often triangular, spot or swelling occurring in the substance of the conjunctiva to either side of the cornea of the eyes of older people. It is not painful nor is it of any special consequence.

PINK EYE. A common term for an acute contagious form of conjunctivitis. See *conjunctivitis.*

PLASTIC LENSES. Perhaps the greatest disadvantage and danger of spectacle lenses as we ordinarily know them is the ever-present hazard of breakage. This subjects one not only to the handicap of being without his glasses until they can be replaced, but also of frequently incurring the risk of injury to the eyes and face from flying bits of glass. This problem

gives fair promise of being solved by substituting some of the recently developed plastics for glass in lenses. This plastic (known chemically as polymethyl methacrylate or as a group as acrylic resins, and by such trade names as Lucite, Plexiglas, Crystalite, etc.) is clear and water-white, more transparent than optical glass, weighs about half as much, is unbreakable from all ordinary shocks, when broken will not shatter and fly, and can be ground with as much precision as glass not only into spectacle lenses but also into the little contact lenses that fit into the eye. It is probable that processes will be developed for molding it directly into standard sizes and powers of the most commonly used lenses, thus eliminating expensive grinding and cutting the cost of glasses considerably. It appears to be an ideal answer for glasses of persons especially exposed to blows and other accidents—workmen, children, athletes, etc. It may also be tinted and used for lenses in sunglasses.

See also *lenses* and *glasses*.

PLASTIGLASSES. A term sometimes used for eyeglasses, either of the usual spectacle or of the contact sort, in which the lenses are of the new transparent plastic. See *plastic lenses*.

PLUCKING THE EYEBROWS. See under *eyebrows and eyelashes*.

POLARIZED LIGHT. See under *Polaroid Glasses*.

Polaroid Glasses. A recent development in the field of sunglasses which offers an effective means of screening reflected glare from the eyes (see *glare*). They are merely spectacles of the customary sunglass type having lenses of the new Polaroid material. Polaroid is a transparent sheet material, developed by Edwin H. Land, which has the property of polarizing light passing through it. Light being a form of radiant energy is propagated or travels in waves. Ordinary light as it comes from a source (the sun, electric bulb, a candle, etc.) has waves moving in all planes passing through an axis drawn from the observer to the light source; some of the waves are in the horizontal plane, some in the vertical, and others in all conceivable planes between these two. Polarized light, on the

other hand, is light whose waves move or vibrate in *one* plane only; while appearing the same as ordinary light to the eye, it possesses special properties, some of which are made use of in Polaroid glasses and lamps.

Polaroid is a material made up of a thin film of tiny, microscopic needle-like crystals (billions to the square inch) of a combination of iodine and a quinine salt. These crystals lie side by side with their axes parallel, imbedded in a thin sheet of synthetic resin which is held between two thin sheets of glass for greater physical strength and durability. These crystals are able to polarize light passing through them.

Now one of the bad features of glare is reflected glare, such as comes back from a shiny book page, table top, highway, water or the like. Light reflected from a shiny, non-metallic surface is of two sorts: specular (or mirror-like) which produces most of the glare, and diffuse, that which to some extent penetrates the surface and is given back in a "spread-out" non-glaring form; it is by the latter sort that we see best, while the former serves mainly only to blind us. It so happens that this specular light becomes pretty thoroughly polarized through its reflection. Consequently, by putting Polaroid glasses before the eyes this glare is screened out, since the Polaroid will pass light waves in one plane only and the lenses are so set in their frames that this plane will not be that of the reflected polarized light. The diffuse reflected light readily passes through the lenses, of course, and supplies the light for seeing. Polaroid glasses are of special help to automobile drivers, boaters, etc., for whom reflected glare constitutes a real discomfort or hazard.

Polaroid glasses, however, are of little effect against direct glare that has not been reflected (as direct headlight beams, etc.). But there is now available a special form consisting of double Polaroid lenses so mounted as to permit the one to be rotated at will and thus crossing their polarizing axes to any extent desired. The first lens polarizes the incoming light and the second lens screens out this polarized light in proportion to the amount its axis is crossed with that of the first, until at right angles no light at all is passed through the combination. Such glasses can be set to screen out any amount of direct glare or light desired.

One disadvantage of Polaroid glasses is that they cannot be ground to one's prescription for a refractive defect of sight, but certain recent advances in their manufacture gives promise that this may soon be possible.

See also *Polaroid Lamps* and *sunglasses.*

Polaroid Lamps. These are moderate size table lamps with conical shades of the customary design having the space at the bottom of the lamp shade, which ordinarily is open, closed by a piece of Polaroid. The light coming down from the bulb passes through this screen and is polarized, and will thus not be reflected from any shiny surface (book page, table top, etc.) beneath the eyes to any great extent. Reflected glare is in this way largely eliminated since the polarizing effect of the reflecting surface will cross and halt the polarized light reaching it. The light penetrating the surfaces will be given back as diffuse and will supply the light requisite for vision without the blinding and troubling effect of glare. For a discussion of Polaroid and polarized light, see under *Polaroid Glasses.* See also *glare* and *lighting.*

"POOR" EYESIGHT. See *defective sight.*

PRECAUTIONS WITH GLASSES. See *care of glasses.*

PRECAUTIONS WITH THE EYES. See *care of the eyes.*

PREGNANCY and sight. Approaching motherhood is beset with a number of possible complications of varying degrees of seriousness, the danger of any of which may be lessened if their early symptoms are heeded and adequate precautions taken. One frequent indication of these complications of pregnancy is a marked blurring or graying of sight. This may especially signify acute kidney trouble or any of several grave toxic conditions peculiar to pregnancy. Defective sight of this sort does *not* as a rule call for glasses, but for treatment of the underlying conditions causing foggy vision. Women in this state who consult the average optometrist about their eyes run the great danger of merely having glasses prescribed while their real trouble is overlooked and neglected and allowed to develop into something serious, not only to the

mother but to her child as well. This mistake has brought a number of expectant mothers close to death through one of the most terrible of pregnancy complications, eclampsia or childbirth convulsions. Pregnant women who note any disorder in their vision should *never* go to an optometrist or to a department store optical shop for attention, but only to a physician or oculist.

See also *prenatal care* and *care of the eyes.*

PRENATAL CARE and sight. One of the most important features in the conservation of sight is the constant alertness that must be exercised in safeguarding the eyes of young persons (see *baby's eyes* and *children's eyes).* But to insure the best possible sight for one's offspring this care must be begun even before the child is born, during pregnancy, through the attention the mother gives herself in order that the child within her and all his organs, including of course his eyes, may be formed and develop as nearly normal as possible. This, naturally, is largely a matter of the routine daily physical and mental hygiene of the mother in order that she keep in robust health, free of bodily disease, disorder, and infection, and cheerful and contented in her outlook—this is necessary for the all-round benefit of the forming child. Most important in this is the question of the mother's diet. It must be ample, nutritious, and balanced in order that the growing child be supplied with the proper "building materials" for all its tissues and organs. As for the baby's eyes, it is imperative that the mother's diet include a sufficient amount of vitamin A, preferably from foods rich in this element (see under *night blindness* for a list of such foods), otherwise supplemented by vitamin pills or concentrates. Notable deficiency of vitamin A for extended periods in expectant mothers has been known to lead to children with deformed and defective eyes and to children who became blind in the first few years of life. Vitamin A plays an essential rôle in the development of the nervous system, and the nerves of the eyes are most complex. The exact details of prenatal care must be under the direction of the woman's physician, as there are many governing circumstances to each case, but it must not be neglected and it must be started early. A woman should put herself under the care

of a competent physician as soon as she discovers she is pregnant, and not wait until the child is almost ready to be born, as too often happens.

See also *pregnancy* and *diet.*

PREPARATIONS FOR THE EYES. See *medicines, patent medicines, drugs, eyewashes, beautifying the eyes,* and *quackery and fraud.*

PRESBYOPIA. This is the technical designation for a condition known more popularly as "old age sight." It does not signify any serious disorder of the eye that might have been avoided by suitable care, but is rather a natural consequence of growing old with a resultant lessening of the elasticity of the lens and ciliary muscle of the eyeball; this brings about some degree of loss of the eye's power to accommodate or focus a clear image on the retina (see *accommodation* and *focus).* The lens has a tendency to remain too flat and a condition of farsightedness develops. This process starts sometime in middle life, varying somewhat with the individual and his general health, but on the average about 50% of the power of accommodation has been lost by the age of 40, after which it ordinarily develops rapidly to about 70% loss at the age of 45, and about 90% at 50; after this any further change occurs very slowly, until after 60 the condition usually remains stationary. The first symptom of the approach of presbyopia is generally an increase in the "near point," the closest to the eyes an object may be held and still clearly seen; the person consequently finds that he must hold printed matter farther and farther from the eyes until finally even arms'-length will not permit obtaining a clear focus of it. The remedy is, of course, glasses with convex lenses (if there is no other complicating defect). In persons who were farsighted in early life this defect becomes aggravated at this time and their presbyopia is likely to start earlier than usual. However, presbyopia tends to counteract nearsightedness to some extent, and persons thus affected may find that their close vision improves with age, sometimes to the point of being able to read without glasses, though they will still require glasses for distant vision. Persons who in their younger life suffered from some refractive defect will usually find that they

need different glasses for close and distant vision; this necessitates having separate glasses for each and changing as occasion demands, or the handier solution of bifocal lenses.

See also *farsightedness, lenses, glasses,* and *bifocal lenses.*

PRESERVING THE EYES AND SIGHT. See *care of the eyes* and *conservation of sight.*

PREVENTION OF DEFECTIVE SIGHT. See *conservation of sight* and *care of the eyes.*

PRICE OF GLASSES. There are several factors that go into the total price a person pays for his spectacles: the cost of the materials (the lens blanks, the spectacle frames, etc.), the labor charge for grinding and mounting the lenses, the overhead on equipment and rent, and of course the fee of diagnosis and measurement of the eye defect. If glasses are bought as they should be (see *buying glasses),* this last fee goes to the oculist, the rest to the optician. The optician's part of the price should naturally be the greater since he has material, labor, and investment in machinery to cover, whereas the oculist gives only service. But there is often an improper agreement between the oculist and the optician to whom he sends his clients for glasses by which the optician "kicks back" or "splits" fees with the oculist. This means that the optician must get so much more for his work, which often runs the price of glasses well above what it should be.

There is on the other hand the optometrist who not only tests the eyes but also sells the glasses, lenses and frames, often even grinding the lenses, all in the same establishment. He sets a single price for a pair of glasses, including all services, labor, and materials, and this frequently is considerably less than the total cost by the previous manner of purchase. But there are certain disadvantages and hazards in dealing with optometrists, even the most reliable, unless one can be certain that his eye trouble is only refractive (see *optometrist).* Many of them are unscrupulous and sell the most expensive glasses possible whether or not the person needs them (and unneeded glasses are expensive at any price). In addition, not a few optometrists, either through incompetence or negligence, give little concern to the correctness of the glasses

they sell to persons who require them, thereby increasing expense since the person must soon buy another and proper pair, plus the danger of having one's sight further impaired by wrong glasses. There also are optometrists and optical shops that buy up the many lenses and frames rejected by the manufacturers as imperfect or "seconds," and sell them as first-rate products at "cut rates." Such glasses may have poorly and inaccurately ground lenses, optically off-center, crookedly mounted in inferior frames, and are consequently over-priced at any figure.

Finally, there are the manufacturers of the lenses and frames and the wholesalers and their organizations that often work together to keep the prices of their materials (though of first quality) much above what it should be. Not so long ago a Federal grand jury handed up four indictments against a number of optical companies (some of the best known in the world), wholesalers, trade associations, etc., charging combinations and agreements between them for price-fixing by which the cost of glasses throughout the country has been kept unnecessarily high during the past decade or more. The organizations charged in these indictments were said to make and distribute about 95% of all eyeglass materials used in this country. It was estimated by one of the investigators that a pair of glasses that cost the customer $20 could be sold at a fair profit for only $7.50. Such practices, of course, deprive poor people of badly needed glasses and drive many others to inferior products; these price-fixing agreements also prevent people from having necessary changes of glasses made because they are too expensive.

The conclusion to be reached through all this is that any one buying glasses today is likely to pay more than they are worth; that by carelessly choosing the persons with whom he deals he will pay more than would otherwise be the case, perhaps even buying glasses he does not need at all; that by patronizing certain unscrupulous dealers he may pay high prices for an inferior or worthless article; and that if he tries to save money by going to a cut-rate shop he is almost certain to get (if they fail to high-pressure him into an expensive pair) glasses made up of "seconds" and inferior materials that are not worth anything like even the bargain price paid. In the

interest of one's eyes one should not try to get too cheap glasses, though high price is certainly no guarantee of high quality merchandise. The spectacle purchaser can at present do no more than choose men (oculist, optician, and optometrist) of the highest reputation to deal with, make certain that the materials used are of good quality and made by firms of established, national reputation, and to ascertain by inquiry and comparison with other dealers of similar standing that the price charged is not too much out of line with the average in that locality.

See also *glasses* and *examining the eyes.*

PROGRESSIVE MYOPIA. See under *nearsightedness.*

PROPTOSIS. A protrusion or bulging of the eyes from their sockets. See *bulging eyes* and *exophthalmos.*

PROTECTING THE EYES. See *care of the eyes, conservation of sight, goggles, sunglasses,* and *injuries to the eye.*

PROTHESIS (ocular). An artificial or glass eye. Also, *prosthesis.*

PROTRUDING EYES. See *bulging eyes* and *exophthalmos.*

PSYCHOLOGICAL FACTORS AND SIGHT. See *emotion and sight.*

PTERYGIUM. A thickening or growth on the conjunctiva extending from the edge of the eye to, or sometimes beyond, the margin of the cornea. It is generally triangular or fan-shaped, with the point toward the cornea. As a rule it is not especially serious and causes no trouble, but sometimes unless checked surgically it may extend to cover most of the eye.

PTOSIS. A drooping, partial or complete, of the upper eyelid. When complete, the sight is naturally obscured. It may be present from birth, in which event it is usually due to weakness or absence of the elevating muscle of the lid, or it may be acquired in adult life as a result of paralysis of this muscle. Where the drooping is enough to amount to a handicap, it may be remedied by surgery. A partial ptosis may

follow thickening of the upper lid from a chronic conjunctivitis, and is often an aftermath of trachoma.

PUPIL of the eye. The space or opening in the approximate center (it is a trifle off-center toward the nose) of the iris. It is through the pupil that the light rays pass to the crystalline lens to be focused on the retina. Through the action of light intensity on the iris, the pupil becomes larger as the light grows dimmer, and smaller as the light grows brighter, thus automatically regulating the amount of light admitted into the eye and protecting it under most circumstances from excessive amounts. The largest opening of which the pupil is capable is about 20 times that of the smallest. The pupil tends to become smaller with age: for the same light intensity, it has about half the area at the age of 50 that it had at 20; thus, old people see less well in dim light than do young, and they require more illumination for reading and close working. The appearance, shape, and action of the pupil often furnish the expert with valuable indications of disease or disorder of the brain, even when no other symptoms are present, and thus permit early diagnosis and treatment.

See also *iris, eye,* and *sight.*

PURCHASING GLASSES. See *buying glasses.*

QUACKERY AND FRAUD. In almost every branch of medicine there are unprincipled individuals who ape the methods of conscientious practitioners, distort the findings of true science to suit their own selfish purposes, and exploit the general public through a host of fantastic "cures," "treatments," "systems," patent medicines, worthless devices, etc. To this the disorders of the eye and the defects of vision are no exception—indeed, there are few branches of medicine more infested with quackery and charlatanry.

In the field of eyes and vision, quackery and fraud take many forms, the more widespread and lucrative of which are indicated below for the guidance of those who wish to keep clear of them.

One of the most widely exploited branches of eye quackery is that of eye exercises for the improvement of sight, the "sight without glasses" racket. In this the quacks sell courses

or systems of exercises, publish books detailing their "theories," and give personal office consultation and instruction for fat fees. This nonsense finds wide acceptance even among people otherwise quite intelligent, prompted probably by the earnest wish to be relieved of the burden of glasses. See *"Sight Without Glasses," exercise,* and *orthoptics.*

An elaboration of the above is the type of mechanical gadget which is held against the eyes and manipulated. These devices are supposed to "exercise and rotate the eyes most beneficially." Not only can they do nothing of the sort, but in many cases the pressure against the eyes may be harmful. See *Normalizer.*

No inconsiderable factor are the many patent medicines, preparations, lotions, washes, etc., for the eyes, either for mere "soothing and refreshing" purposes or for the "cure" of some disorder. At best these are harmless mixtures; at worst they may contain some harmful substance; in all cases they are ineffective for their advertised purpose. No medicines or lotions should ever be used on the eyes except those prescribed by a physician. See *patent medicines* and *eyewashes.*

Another phase of the above is the group of preparations and cosmetics intended as an aid to beauty. Many of these, if got into the eyes, will cause serious irritation and even permanent damage. See *beautifying the eyes.* Some beauty products not used near the eyes or on the face at all (as certain reducing medicines and hair removers) contain agents that enter the system and produce sight impairment, blindness, cataract, even death.

Then there is the quack eye practitioner who may have a fixed establishment or office somewhere (at least until the local authorities catch up with him), but more often travels about and imposes upon rural folk to whom regular medical and clinical services are not readily accessible. Their commonest approach is the "cataract cure." Usually an itinerant spectacle salesman will travel about and, in the process of disposing of his wares, he will spot likely prospects—this means persons, usually elderly, who are simple enough to believe their insincere talk and who have money enough to make it profitable. In the process of "examining" the person's eyes for spectacles, the salesman "discovers" signs of rapidly grow-

ing cataract which is certain soon to lead to blindness. After thoroughly scaring the poor old soul, he comforts him by saying that fortunately a great doctor, usually a "famous European specialist," is coming through in a few days, and he can persuade the "specialist" to operate for the ridiculously low fee of whatever he thinks his victim is good for. The "specialist" appears in due time and, after some impressive hocus-pocus including usually a display of shiny instruments, puts "drops" in the eye with great flourish; he finally lifts off the "cataract"—usually a piece of egg skin or other whitish membrane that the quack has palmed and seems to pull from the eye—and the pair speedily depart with the money. Some of these fakers make a show of employing electrical machines to "dissolve" the cataract, but this was commoner years ago when electricity was more of a novelty than at present. See *cataract.*

Not least of eye frauds is in connection with glasses. The worst danger here is the unscrupulous optometrist (not of course the conscientious ones) whose only aim is to sell glasses to every customer, whether the customer needs them or not, for as much as possible, or who sells inferior goods for top prices. See *optometrist* and *price of glasses.* There are also the traveling spectacle peddlers, and the spectacle counters of 5-and-10 and department stores with their "choice by trial" glasses, all of which are bad. See *mail-order glasses.*

This by no means covers all the phases of eye quackery, but it should serve to acquaint one with the major guises under which it operates and so enable one to take precautions to avoid it.

See also *examining the eyes, care of the eyes, buying glasses,* and *glasses.*

READING. As the years go by, reading is becoming a more and more important factor in civilized life. Not only most of what we learn but much of our livelihood and recreation comes to us in this manner. It has been estimated, for example, that a private secretary of today has to do about five times as much reading as in 1900, and the use of the eyes for this purpose is still increasing. Thus, the improper performance of

reading may offer a serious handicap—about 60% of all failures in school are laid to this cause—while correct reading habits are an intelligent precaution for protecting the eyes and conserving sight. Nevertheless, it is calculated that about one-half the adult population of this country reads incorrectly and with difficulty.

Correct reading habits are essentially a matter of using the proper eye movements in covering printed matter. In reading the eyes do not, as most people think, move continuously from word to word, but jump or hop from one group of words to the next, taking in a certain number of words each time, pausing while these words register in the brain, moving on to the next group, pausing again, etc. The number of words taken in at each "hop" is called the "span of recognition" and varies somewhat with individuals. A poor reader can span only about one short word at a time and must laboriously break up longer words into parts to be re-aligned in the brain, thus making for very slow reading. It has been estimated that the average good college reader can span about 1.2 words; a very good reader can manage about 2 words or a little better; while a few exceptional persons can handle as many as 5 or 6 words at a time. Naturally, the more words taken in at a glance, the more efficient the reading. At the end of each span there is a period of "fixation" for the brain to comprehend the words, and these periods are calculated on the average to consume about 94% of the time spent in reading. Consequently, the shorter the fixation, the faster and more efficient the reading. Finally, the eye may travel back over words already scanned because of uncertainty, poor grasping of them in the first place, or the like. These are called "regressions," and constitute a waste of time and effort and a slowing up of reading. To correct bad reading habits and train in efficient and rapid reading, one must be so coached and governed as to increase the span of recognition, shorten the period of fixation, and reduce regressions to a minimum. There have lately been invented two machines that aid greatly in this corrective training: one, the Ophthalm-O-Graph (which see), that makes a pictorial record of the reader's eye movements and thus permits their faults to be analyzed; and another, the

Metron-O-Scope (which see), which can be used to induce a regular and correct rhythm in the movements of the eyes as they read.

But there are a number of other factors under one's immediate control that help to make for efficient, comfortable reading, the more important of which follow:

Ample and correct illumination is indispensable for reading and all close work. It should be of sufficient intensity to permit easy seeing and so placed as to avoid all direct glare, reflected glare, and shadows on the book (see *lighting, lamps,* and *glare).* Generally speaking, light coming from one side and a bit above and behind the person is best for reading; tradition has it that the left side is preferable, but actually there is little to choose between the two sides so long as no shadows are cast on the page. There should be some general illumination in the room besides the reading lamp in order to avoid sharp contrasts that may cause eye strain. Since the pupil of the eye gets smaller with age (see *pupil),* old people require more light for reading than young. Also, the amount of light needed depends somewhat on the nature of the reading matter; fine print on rough paper requires more than large print on smooth paper. It is estimated that it takes about three times as much light to read a newspaper as a well-printed book.

Reading matter should be held about 14 inches from the eyes as it is at this distance that the eyes best accommodate for close vision. If it must be held closer, it usually indicates that glasses are needed.

One should be in a comfortable, fairly erect position when reading. Lounging, drooping postures, or leaning to one side on an elbow will tend to throw the eyes at an angle with the line of print and cause eye strain.

The book should be held up high enough so that the eyes remain in about their straightforward position and are not subjected to prolonged muscular strain to keep them pointed downward. This is doubly important if glasses are worn (unless they be bifocals) in order that vision be through the center of the lenses, which is optically better than the edges, and the lenses be at about right angles to the line of vision.

Wearers of bifocals who do a great amount of reading should have special glasses with suitable single lenses.

One should not read continuously for too long periods without rest. One should train oneself periodically to look up from reading matter every 15-20 minutes and gaze at the opposite wall or out of a window for 20-30 seconds, after which reading may be resumed. This relaxes and rests the ciliary muscle and reduces eye strain.

One should not read very fine print any more than can be helped. This is especially important for children. There may be obtained a list of books, for adults and children, all of which are printed in large, easily read type, 12 point or larger: *Books for Tired Eyes,* by Charlotte Matson and Dorothy Wurzburg, American Library Association, 65c.

Extensive reading should not be done when one is exceptionally tired or fatigued; the eyes get as weary as the body and, like it, require sufficient rest and sleep.

Children should not be encouraged to read too much or too young as it puts an unwise burden on their developing eyes. It is recommended by experts that children should not be permitted to start reading before they attain the mental age of 6½ to 7 years.

For a more detailed treatment of the problems of reading and their solution, see *Controlled Reading,* Earl A. Taylor, American Optical Co., Kansas City, Mo.

See also *reading in bed* and *reading while sick.*

READING IN BED. There is some difference of opinion as to just how harmful this practice may be, but all agree that it is not especially advisable. The chief objections are that it is usually done in a strained, unnatural posture with the eyes forced downward toward the book too much, and that the illumination is not likely to be what it should. Therefore, when one reads in bed it should not be in a lying position, but comfortably propped up so that the book may readily be held without effort in the direct line of vision, much as it would be when one is properly seated. And the conventional little bed lights, however charming in appearance, should not be depended upon for light as they were never intended for

this purpose; they give inadequate illumination. A sufficiently powerful indirect floor lamp with diffusing bowl is very good, or a properly shaded bridge lamp beside the bed, or a shaded clip-on lamp on the head-board will serve very well, provided that bulbs of adequate wattage are used. In addition, all the rules of correct reading should be observed (see *reading*).

There have lately been developed special spectacles to permit reading while lying down. These are contrivances made up of a system of prisms and mirrors which enable one to see a book resting on the bedspread while lying flat on the back with eyes pointing toward the ceiling. They require a little time to become accustomed to.

See also *reading while sick.*

READING WHILE SICK. Persons who are ill or convalescent find time on their hands, and frequently turn to reading as an escape from boredom; but this is the worst of all possible times to do any extensive reading. The eyes usually follow and reflect very closely the condition of general health of the body; when the body is weak and its resistance low, the eyes are frequently likewise (see *disease and sight*). Overuse and strain put on them at this time is likely, if done to excess, to result in some impairment of vision. Since one cannot be certain how much his eyes are affected by his illness, it is safest to read but little during this time. If reading is done, it should *never* be for hours on end, but only in easy periods of about 15 minutes with rest periods between of 5 or more minutes; the total reading should not amount to more than 3-4 hours in 24, preferably less. Naturally, all the precautions to be observed for reading in bed and for everyday reading should also be heeded at this time (see *reading* and *reading in bed*). These restrictions apply to other close work as well as to reading—writing, embroidery, etc. Nor should this vigilance be relaxed as soon as the major illness has passed, but should extend through the convalescence as well, and even for some time thereafter, for the eyes often require extra time to regain their strength.

REDDENED EYES. See *bloodshot eyes* and *conjunctivitis.*

REFLECTED GLARE. See under *glare.*

REFRACTIVE DEFECTS or ERRORS of the eye. A general term for the visual defects resulting from some imperfection or distortion of the eye that interferes with its correct refraction or focus. These defects may be nearsightedness, farsightedness, or astigmatism (which see), or some combination of them.

REMEDY OF DEFECTIVE SIGHT or VISION. The proper correction of any eye trouble or sight impairment depends, naturally, upon the nature of the disorder or defect (see *defective sight*). The first step to be taken, then, is to consult a trained physician or oculist in order that a diagnosis may be made and corrective measures prescribed (see *examining the eyes*). If the sight deficiency is due only to some refractive error of the eyes, glasses of a suitable kind and power must be worn (see *glasses, lenses,* and *buying glasses*). If some disease condition of the eyes is the cause of the ailment, the remedy will be through medication, surgery, or a combination of the two (see *diseases of the eye, medicine,* and *operations*). If some general bodily disease, systemic poisoning, or the like, is affecting sight, the approach must be largely through treatment of the underlying causative condition according to individual circumstances (see *disease and sight*). If the trouble is double vision or any of the consequences of muscular imbalance between the two eyes, correction will be through glasses, surgery, or eye exercises, or some combination of them (see *double vision, cross-eyes, and orthoptics*). Whatever the treatment indicated, it should be handled by the most expert man available; the patient should faithfully coöperate in it at all times; and it should be attended to at the earliest opportunity, for prompt treatment increases the chances of recovery whereas neglect often leads to serious harm. And it is always to be remembered that the eye is no fit subject for self-treatment or home remedies, but requires the best medical attention available. Nor is it to be forgotten that there are many charlatans operating in this field who often appear more plausible than legitimate doctors, but who offer a danger even greater than that of self-treatment, and these are to be rigorously avoided in all their many aspects (see *quackery and fraud*). Finally, the best cure is prevention, and the best pre-

vention is the regular daily attention and hygiene that every one should give his eyes (see *care of the eyes*).

For further information, see under the particular ailment or defect in question.

RESTING THE EYES. Prolonged muscular effort of any sort at length brings on strain and fatigue; if a heavy burden is long held the arm muscles get cramped and weary. But if the burden is put down even for a short time and the muscles allowed to relax, they can then again support it with renewed vigor. And so with the eyes. Looking at objects closer than 20 feet away necessitates a muscular effort on the part of the eyes in order to obtain clear vision (see *accommodation* and *muscles of the eyes*). This effort is greater as the distance is shorter, and it must be maintained the whole time that close vision is being performed. Thus, close eye work (reading, writing, sewing, etc.) constitutes a burden for the eye muscles just as much as a weight does for the arm muscles; likewise, they are refreshed and again made fit for their work by periods of relaxation. The eye muscles are relaxed simply by looking at distant objects, anything more than 20 feet away, or by closing them and visualizing in the mind a distant scene, as a mountain range—to think of something close, as a printed page, may tend to keep the eye muscles tense. One should therefore train himself when doing close work to look up from it in this fashion for a short time (even 20-30 seconds are beneficial) at regular intervals, say every 15-20 minutes. And even when not doing extended close work, it is advisable from time to time during the day whenever opportunity offers to close the eyes for a few minutes. This practice faithfully followed is an excellent protective measure against eye strain and the physical distress it may entail; and for women it is an excellent beauty treatment for keeping wrinkles and crow's-feet from around the eyes. Of course, these brief periods will not furnish all the rest and restoration the eyes require; for this ample sleep is needed, preferably in a completely dark room.

See also *care of the eyes*.

RETINA. A thin membrane lining the inner surface of the eyeball, being attached to the choroid. It is as thin as fine tis-

sue paper, yet it is highly complex and consists of ten layers, the innermost of which is made up of the light-sensitive nerve endings, the rods and cones, by which light is transformed into nervous impulses which are carried to the brain to produce the impression of sight; the impulses go by way of the multitude of tiny nerve fibers which converge into one large trunk, the optic nerve, which passes from the rear of the eyeball; at this spot there are no light-sensitive nerves and consequently no sight, and this place is known as the "blind spot" of the retina. The rods are best for perceiving light and hence function well at low levels of illumination; the cones function best under bright light and are able to perceive fine detail and color—the rods cannot sense color, only light and dark. There are about 130 million rods in the retina and about 7 million cones. At approximately the rear center of the retina, in line with the pupil and lens of the eye, is a small area about 3 millimeters across known as the *macula lutea* or "yellow spot" because of its yellowish pigmentation. In this area there are both rods and cones, and it is here that the great majority of seeing is done and all detailed vision and color perception is obtained. At its margin there are relatively few cones, mostly rods, but the proportion of cones increases as one moves inward until at its center, in a tiny depression called the *fovea centralis,* there are cones exclusively. The fovea is the place of keenest vision. Elsewhere on the retina only rods are present. These rods and cones also play a part in the eye's accommodation to changing light intensities: in the presence of a bright light the cones shorten and the rods lengthen, and the retina is thus protected from a painful reaction to too bright illumination; on entering dim light the process reverses. This procedure requires a little time to be complete, which accounts for our inability to see well, or being "blinded," on passing from a dark to a bright room, or vice versa, and our gradually getting accustomed to the new illumination.

If the retina is damaged, sight is impaired. Damage may occur as a result of a blow on the eye, disease, or disturbances in the circulation of the blood in it from various causes. Its commonest disorders are retinitis, or inflammation, which occurs in a number of forms, one of the most serious of which

is retinitis pigmentosa; tumor, which is found in children more than in adults, an indication of which sometimes is the shining of the eye in the dark like a cat's, and which almost always ends in blindness; and one of the most dread of all retinal disorders, detachment from the choroid, which may be the result of a severe blow on the eye, a heavy physical strain, some kidney inflammations, glaucoma, progressive myopia, etc. It will lead to blindness, partial or complete, which may come on quite suddenly. Early treatment is often helpful in this disorder, and of late there has been a certain amount of success with an operation for the re-attachment of the retina. (See also *diseases of the eye.*)

The appearance of the retina (which is the one place in the body where the nerves and blood vessels may be observed in actual function) can tell the experienced oculist a great deal concerning the health of the eye and even of the body as a whole; for it is there that some of the earliest symptoms of a number of diseases make their appearance, and their recognition will permit effective treatment to be instituted without delay. Therefore, a careful examination of the state of the retina should form part of all eye examinations (see *examining the eyes*).

See also *eye, sight,* and *visual purple.*

RETINITIS. See under *retina.*

RHODOPSIN. Visual purple, which see.

RHYTIDOSIS. A sinking in and wrinkling of the cornea. It is one of the signs of approaching death.

RODS of the retina. One of the two kinds of light-sensitive nerve endings of the retina, the other kind being *cones* (which see). The rods predominate, there being about 130 million of them as against about 7 million cones. The rods (so called because of their shape) are present exclusively in the portion of the retina away from the central area, the *macula lutea* (which see); in the latter cones start to occur and become more numerous toward the center until at the tiny central depression in the macula, the *fovea centralis,* only cones are to be found. The rods are sensitive only to light and dark, per-

ceive no color or fine detail, and function best in dim illumination.

See also *retina.*

Roux Lash and Brow Tint, Black. A patent eyelash dye which has been condemned as dangerous because it contains a silver salt as its coloring agent. Should it get into the eye, it may work serious and permanent harm. See *beautifying the eyes* and *quackery and fraud.*

RUBBING THE EYES. This is a thoughtless practice much too commonly indulged in to relieve fatigued, strained, itching, or burning eyes. It has nothing to recommend it and much to condemn it. If too vigorously done, it may cause actual damage to the eyeball or lids. If grit is in the eye it may scratch the conjunctiva through rubbing. If there is an irritation or inflammation of the eye it may aggravate it. And if rubbing is done with dirty fingers (as frequently it is), it offers a quick means of introducing infection into the eyes. If one desires to relieve a mild irritation or itching of the eyes, bathing in plain water or normal saline solution is much preferable; if anything more is required, it should be prescribed by a physician.

SALINE (NORMAL) SOLUTION. See *normal saline solution.*

SALVES for the eyes. See under *patent medicines.*

SAVING EYES and SIGHT. See *care of the eyes* and *conservation of sight.*

SCHOOL AND SIGHT. Schools are of course one of the most important instruments of civilization and culture. It is a pity, therefore, that the manner in which they are conducted makes them one of the chief contributing causes of defective sight among our young people. The growing number of school children needing glasses, the percentage of which increases for the higher ages, is a matter of great concern to oculists, educators, and all interested in the eyesight of the nation. The fault lies primarily in the antiquated teaching methods still widely in vogue which call for an unnecessarily large amount

of eye work in close and detailed vision, and an excessive amount of homework which not only adds further to the eye work but virtually forces it to be done under poor conditions of illumination, posture, etc.; all these throw an unnatural strain on the immature growing eyes of young people. Moreover, many school buildings still in use were built at a time when there was little regard for correct lighting, prevention of glare, and proper seating and working arrangements.

So alarming has this situation become that in many localities authorities are beginning to take both preventive and corrective steps against it. For the former, they are remodeling schoolrooms with an eye to suitable illumination, seating, and all factors that make for comfortable seeing, and revising teaching methods to cut out much close eye work, substituting oral drill and vocal instruction, and reducing homework to a minimum or eliminating it entirely. On the corrective side, they are instituting routine eye examinations of all children to catch any defect as early as possible, and arranging that glasses or other treatment is given where needed; and for children whose sight, even when corrected by glasses, is such as to render them unsuited for regular classroom work (not only in so far as it may further damage their eyes, but also in that they may act as a hindrance on the progress of the other), the setting up of special "sight-saving classes" in which every effort is made to spare and conserve the sight. The latter include adequate lighting without any glare; soft-finished, dull walls; no high lights or sharp contrasts present in the room; movable desks so that the children may sit wherever they can see best for different kinds of work without being anchored to one spot for everything; special textbooks in large, clear type on soft non-shiny paper; special pens and pencils for making thick and easily seen lines; special maps and other visual material that may be seen without effort; the use of oral instruction wherever possible; and the careful instruction of the children in proper methods of reading, writing, using light, and all that pertains to the preservation of the eyes and sight. These classes are for children with advanced eye impairment or with some disorder (as progressive myopia) that may be aggravated by too much eye work. Since there are usually not enough students in any one school to make up such a class,

students are brought together from a number of schools for the purpose. There are at present almost 500 of these sight-saving classes in the United States, and it is to be hoped that their number will continue to grow until there is one available in every locality.

One thing that can and should be done at once in all schools is to make some provision for sparing the eyes of a child, from even ordinary use for a time, when he returns to school after a period of sickness and his eyes are weakened and in no condition to resume their normal duties (see *disease* and *sight*). Instead, it has been the general practice of school teachers to overwork the returned child and his eyes, and load him with extra portions of homework, in an attempt to have him "catch up" with his class. It is preferable that a child finish his schooling six months or a year later and retain his good eyesight, than that he graduate on some predetermined schedule (usually to satisfy parents' vanities and teachers' routine) and spend the rest of his life burdened with poor vision. No real progress can be made in the conservation of the sight of the nation unless an effective beginning is made at the bottom, and that is the sight of our children from the day they are born, and unless parents and teachers, health and school authorities work together toward this end.

For an excellent detailed discussion of the problem of protecting the sight of school children, the correct arrangement of schoolrooms, lighting, desks and equipment, and all allied matters, one may obtain for 20c from the Government Printing Office, Washington, D. C., Bulletin, 1919, No. 65, *The Eyesight of School Children,* by J. H. Berkowitz.

See also *children's eyes.*

SCLERA. The tough membrane that makes the outer layer of the eyeball. Where exposed between the lids it appears as the "white" of the eye. In the center of the front it is transparent and bulges outward, forming the cornea behind which lie the iris and crystalline lens. To its outer surface are attached the six external muscles that move the eyeball within its socket. Lining the inner surface of the sclera is the choroid (which see) which in turn supports the light-sensitive retina.

See also *eye* and *sight.*

SCLERITIS. Inflammation of the sclera (which see). It is rather a rare eye disorder. It appears as an inflamed red patch on the white of the eye and the eyeball feels tender and aching. It may occur in only the outer layers of the sclera, in which case it will usually clear up in a few weeks; but if it affects the deeper layers it is much more serious, the inflammation may spread to other nearby structures of the eye (choroid, iris, cornea, etc.), and the condition may persist for years, in which event there may finally be some scarring of the sclera and vision impairment. This disorder calls for careful treatment by an oculist.

See also *diseases of the eye.*

SCOTOMA. A partially or completely blind spot in the field of vision. It may be small or large, of regular or irregular shape, and there may be more than one present (in which case they are called *scotomata,* the plural form of the term). They are the result of scars on the retina from puncture wounds of the eye, the nerve-endings or rods and cones in the scar being damaged or destroyed and sight in that spot with them; or disease within the eye in localized patches (as in particular with choroiditis) may terminate in the same way. Also, disease of the optic nerve may affect a group of the nerve fibers running from the retina to the brain, thus interfering with the transmission of the light impulses and producing a scotoma at that portion of the retina they run to (see *nerves of the eye).* The rest of the retina may be quite capable of normal sight and, if the spots are not too large, vision will be but little interfered with since that portion of the visual field will be covered by the sight of the other eye. But if the spots are large and present in both eyes, vision is likely to be much affected. Any one noting scotomata in his visual field should consult an oculist at once so that their progress may be halted if they are growing.

Scotomata should not be confused with the physiological *blind spot* (which see) which is normally present in the eye.

"SECOND SIGHT." An improvement in the vision of far-sighted persons, usually of somewhat advanced age, at times to the point of enabling them to read a newspaper without

glasses. It is a result of the hardening and thickening of the crystalline lens so that it becomes more convex, has a shorter focal length, and is able to throw a clear image of a close object on the retina (see *focus* and *farsightedness).* This hardening process may be a consequence of age, but is often an early symptom of cataract and may eventually end in blindness.

SEEING. See *sight.*

"SEEING DOUBLE." See *double vision.*

SHADOW TEST. An objective means (one that does not depend upon the response of the patient) for determining refractive defects of the eye. The examiner sits before the patient and holds a small mirror about 20 inches before the eye (the pupil of which has usually been dilated with "drops") in such a manner as to reflect light into it. As the mirror is moved a shadow is seen in the eye that moves with the motion of the mirror in the case of farsightedness and against its motion when there is nearsightedness. Astigmatism gives a band of shadow. If the mirror is so mounted as to measure the degree of its motion, an estimate of the extent of the refractive defect may be made. This maneuver is also called *retinoscopy, skiascopy,* and *pupilloscopy.*

See also *examining the eyes* and *testing the eyes.*

SHORT SIGHT. Nearsightedness, which see.

SICKNESS AND SIGHT. See *disease and sight.*

SIGHT. Sight is one of the five traditional basic senses of the body, and is the most complex and valuable of all to the average person, its only possible rival on either of these scores being hearing. Sight and hearing are usually the last two senses to develop in the young; this is probably due to their complexity and the intricacy of the coördination necessary between their vast number of parts which require a period of training in order to work together, before these senses can be correctly established in their functions.

In order that there be sight, three things are indispensable: an object to be seen, a functioning eye to see it, and light to

supply rays to carry stimuli from the object to the eye to enable the latter to form a visual impression of the former; the absence of any one of these destroys the possibility of sight. The eye, or more broadly the seeing apparatus (for much of the seeing mechanism lies outside the eyeball proper), consists of three main portions: the refractive part that focuses an image of the object on the retina (the lens, cornea, and aqueous and vitreous humors, which see); the muscles, both internal and external to the eyeball, that bring the refractive portion into focus and convergence on the object (see *muscles of the eye, accommodation, focus,* and *convergence);* and the system of nerves and nerve endings, including the centers and inter-connections in the brain, that react to the focused image on the retina and carry the resultant nervous impulses to the visual centers of the brain where they are organized into a visual impression of the object looked at in accordance with the image of it thrown on the retina by the refractive media of the eye (see *nerves of the eye, retina,* and *optic nerve).* However, acute, detailed, colored vision does not take place all over the retina, but only at a relatively very small spot near its center, the *macula lutea* (which see), which is the only portion of the retina capable of such vision. The rest of it serves merely to pick up the presence of an object in the visual field and makes the sight mechanism aware that there is something to be seen in order that it may so adjust itself as to focus a clear image of the object on the macula and get a distinct visual impression of it. Failure or disorder in any one of this multitude of interdependent parts will result in a corresponding impairment of vision.

Sight, then, takes place somewhat as follows: an eye moves about at random in the presence of light until an object falls within range of its visual field. Rays of light strike the object and are reflected back to the eye into which they enter through the pupil and pass through the lens which focuses them, possibly indistinctly, on a portion of the retina; this will be away from the center unless the eye should happen to be pointing directly at the object, which is not likely in chance vision. This is known as "peripheral vision," being on the outer margins of the retina. The nerves of the retina send impulses of this image to the brain which forms them into a visual im-

pression of the object. This vision, being peripheral, will be unsatisfactory to the brain since it will be only of lights and shadows and general outlines and will have no color or fine detail. The brain, wishing to get a clear concept of the object, immediately prompts the eyes, and if necessary the head, so to turn and point at the object that its image falls on the macula of the retina. This gives "macular vision" which enables the brain to form a concept of the color and detail as well as of the contours of the object. But the image on the macula may not be sufficiently well defined, so the brain urges the ciliary muscle within the eye to get to work and so adjust the curve of the crystalline lens that it focuses a sharp image on the macula. But the amount of light reaching the retina may not be right for satisfactory vision, so the brain causes the muscle fibers in the iris to make the pupil larger or smaller according as more or less light is needed, and at the same time makes the rods in the retina lengthen and the cones shorten or vice versa in keeping with the dimness or brightness of the light. These processes, of course, go on in both eyes so that a clear image is obtained in each. The brain then calls into play the external muscles of the eyeballs and has them swing the eyes so they converge and both point at the object; from the amount of convergence necessary to do this the brain is able to estimate the distance to the object, and from the slight difference between the images in the two eyes it can form a judgment of the depth of the object. All this complex process, of course, takes place automatically and practically instantaneously, in the "winking of an eye," so to speak.

This last process of judgment of distance and depth is due to what is known as the "binocular effect" of the eyes, which means broadly the effect from seeing with two eyes as one. It is an advantage enjoyed only by man and a few of the higher animals whose anatomical characteristics are such as to permit both eyes to range the same visual field and both converge on the same spot in it. Animals, like horses, see an entirely different visual field with each eye.

When the eyes converge on an object their lines of vision form a triangle with the line between the two eyes as its base, and the acuteness of the angle of the lines with the base enables

the brain automatically to judge the distance to the object; much the same method is used by a surveyor in measuring distance by triangulation. Beyond fifty feet, however, the amount of movement of the head, perspective lines, and other elements must as a rule also enter for any sort of accuracy in distance judgment.

The other service of binocular vision, depth perception, is possible through the fact that the eyes being some distance apart in the face are each enabled to see the same object from a slightly different position, each one seeing slightly more of the dimension away from the eye on its own side, thus permitting the two of them in effect to "see around" the object to some extent. Each eye throws a slightly different image on its retina, an image a little fuller toward its own side, and the brain takes the two images and fuses them into a single visual impression with a sense of depth or thickness. If for any reason the two images do not fall on corresponding portions of the retinas, the brain will be unable to fuse them into one, and double vision will follow (see *double vision*).

See also *eye, normal sight,* and *defective sight.*

SIGHT, DEFECTIVE. See *defective sight.*

SIGHT, NORMAL. See *normal sight.*

SIGHT, REMEDY OF. See *remedy of defective sight.*

SIGHT, TESTING OF. See *testing the eyes* and *examining the eyes.*

SIGHT CONSERVATION. See *conservation of sight.*

"SIGHT WITHOUT GLASSES." This is a form of eye quackery very popular with the general public. It takes its name from the title of a book, *Perfect Sight Without Glasses,* that was written by one Bates (which see) something over 20 years ago, which has since become the Bible of the multitude of charlatans who have flocked to this field. These quacks promise to cure not only any and all refractive defects of the eyes so that "you may throw away your glasses," but they extend their claims to the cure of eye disorders and diseases, even the most serious of them as glaucoma and cataract, all

without the use of glasses, medicine, or surgery. They claim to accomplish this simply by "natural methods" of eye exercises, relaxing of a special sort (not simply of the eyes but of the body and of the *mind* particularly), and by the correction of "wrong" thoughts. Some of the commonest of the "exercises" employed by them are palming, swaying, and swinging (which see), but ingenious operators are constantly devising new and impressive ones, as shifting, blinking, central fixation, etc. Some even advocate staring at the sun with the naked eye A few add the diet angle, especially those interested in firms putting out diet systems, food products, and reducing menus.

The "theories" behind all this humbuggery bear no resemblance to the views of medical science. Chief among them is Bates' contribution on the mechanism of accommodation of the eye: Science has all these years recognized that this takes place by the change of shape of the crystalline lens under the action of the ciliary muscle, and that the refractive errors of the eye are the result of deformity of the eyeball, its being too long or short. Bates, on the other hand, "discovered" that the eye accommodates through the six external muscles of the eyeball, pulling and squeezing it in such a manner as to alter its shape and length and thus bring the retina to the focus of the lens! Poor sight, according to him, was merely a matter of the incorrect functioning of these muscles and their failure to shape the eyeball correctly. Remedying sight, then, becomes a simple matter of training these muscles (through exercises, thinking "right" thoughts, body contortions, etc.) to do their work correctly, whereupon sight will again become normal. If vision is bad as a result of age, disease, or any other condition, there are other combinations of hocus-pocus that are supposed to restore excellent eyesight.

There is no point in detailing this nonsense further, though this by no means exhausts the imaginative resources of the promoters, many of whom have been caught wearing very thick lenses themselves. Any one interested in this field out of curiosity may find them elaborated in a number of books and pamphlets advertised in many periodicals. But any one who actually falls for such quackery, after the warnings herein given and the scientifically-approved information on the eyes

and sight to be found elsewhere in this volume, deserves no sympathy should he later be forced to visit an oculist and find that his condition has been greatly aggravated.

See also *exercises, quackery and fraud,* and *orthoptics.*

SILVER NITRATE LAW. A term sometimes applied to the law existing in many states making it compulsory for the doctor or midwife to administer a few drops of silver nitrate solution in the eyes of all newborn babies as soon after birth as possible. This is an almost universally effective preventive of later blindness resulting from infection (usually gonorrheal) of the eyes during the process of birth.

See *baby's eyes* and *ophthalmia neonatorum.*

SMOKED GLASSES. See *sunglasses.*

SNELLEN CHART. A standardized chart widely used in the quick testing of visual acuity. It is a large card printed with lines of letters and figures, the size of each line of which is progressively smaller as one goes down the chart. Each line is marked with the distance in feet at which the normal eye should just be able clearly to read the letters in it. The largest line is made for 200 feet, and they decrease usually by 100, 70, 50, 40, 30, 20, 15, and 10-foot lines. The characters are so constructed that their details subtend a visual angle of one minute of arc at the indicated distance, which is taken as the minimum of visual acuity of the normal eye. (For further discussion of this, see under *normal sight.)* The chart is placed 20 feet from the person to be examined (in good light, of course), and he reads down it through the smallest line he can. Should this be the 40-foot line, his visual acuity is 20/40 (20 for the test distance and 40 for the smallest line he could read) or below normal; should it be the 20-foot line, his rating is 20/20 or normal; should it be the 15-foot line, his acuity of sight is 20/15 or better than normal.

There are also symbol or picture charts constructed on the same principle for testing children too young to read and for illiterates. One of the most used types is the E chart which is made up of E's placed in various positions in lines of decreasing size. With this the child or illiterate need merely indicate with his arms the direction in which the legs of the

E's point, as they are pointed to by the examiner, until the line is reached where this cannot be done accurately.

An inexpensive regulation Snellen's Test Chart may be obtained from the American Medical Association, 535 N. Dearborn St., Chicago, Ill.

See also *examining the eyes* and *testing the eyes.*

SNOW BLINDNESS. This is a condition found mainly in northern countries where snow lies for long periods and there is much brilliant sunlight on it. Polar explorers are especially susceptible to it. The prolonged, intense glare from the dazzling white surface causes an extreme congestion and inflammation of the conjunctiva, and the eyes react more and more painfully to light until finally there is spasmodic closing of the eyelids in order to keep out the light; these spasms may become so violent that they cannot be opened at all, even for treatment, and the person is in effect blind. In this condition the eyes water almost constantly and the prolonged retention of these tears under the closed lids may, if allowed to persist, mar the clear surface of the cornea and work permanent impairment of vision. The condition, therefore, should be cleared up as promptly as possible, under a doctor's care if one is available. The person should be confined to a dark room and have complete rest; all means to reduce the inflammation of the eyes should be employed. Compresses of snow over the closed lids are good for this. When the spasm begins to relax, simple washes of boric acid or normal saline may be used.

"SORE" EYES. This term is sometimes applied to reddened, inflamed, or strained and fatigued eyes. See *bloodshot eyes, conjunctivitis,* and *eye strain.*

"SPECKS" BEFORE THE EYES. See *spots before the eyes.*

SPECTACLES. This is occasionally used to designate those types of frames with ear-hooks for holding them in place, and as such is distinguished from *eyeglasses* (which see); but most commonly it is merely a general term for all sorts of glasses. See *glasses.*

SPLINTERS in the eyeball. Sharp particles and splinters, particularly of metal, that fly at high speed are likely, if they strike the eye, to penetrate and stick into the "white" or the cornea. If striking with sufficient force, they may even go through the cornea into the anterior chamber between the cornea and lens. Whereas a cinder or piece of grit that rests simply on the surface of the eyeball can usually be removed safely by one's companion if he is careful, splinters are *never* a matter for self-treatment or home remedies, but only for the most expert professional attention available. Pulling out a splinter stuck in the eye may easily multiply the damage many times, besides offering an easy opportunity for the introduction of infection. Furthermore, once the splinter is removed the injured eye requires medication and attention that only a physician is equipped to give. Should the splinter have gone through and lodged in the anterior chamber, removal is a much more delicate matter. This generally calls for a second opening to be made in the cornea, and this must be carefully done away from the optical center so that any scars that might be left will not be in a position to obstruct sight. If the splinter is of a magnetic metal, an expert operator can often get it out very neatly wtih a special eye magnet. But this, too, calls for special skill. There is a foolish superstition in some shops that metallic chips can be got from the eye by exposing it to the field magnet of a large motor or generator; there are many badly injured and blind eyes as a result of this unreasoning belief—it must never be tried. Naturally, where there is any danger from flying splinters, it is wise to wear goggles as a simple but effective protection against them (see *goggles*).

See also *foreign bodies in the eye* and *injuries to the eye.*

SPORTS and defective sight. There are few, if any, outdoor games or athletic diversions that do not call for reasonably good eyesight. Poor vision, therefore, is likely to deprive one of the benefits of such sports unless it can be remedied; and since the remedy is ordinarily glasses, the danger of breakage and resultant injury is so great as to render them inadvisable in all but a few games (as golf, croquet, etc.) where the hazard is small. However, one need not be shut off from most sports if a few simple precautions are observed. The more

violent games, like football, should as a rule be avoided unless one can see well enough without glasses to play it; but for most others (tennis, handball, badminton, etc.) there may be obtained guards to be worn over the glasses, much like a catcher's mask, that furnish adequate protection, though they may be a little clumsy and hard to get used to at first. Glasses with the new plastic lenses (see *plastic lenses)* are fine for sports in which the chance of a violent blow directly on the eyes is small. If one has the money to spend, a pair of contact lenses (which see) will solve most problems of this sort perfectly, even for football; any blow that would break these lenses would injure the eye under any circumstances. Not least of all is the matter of one's personal behavior in the game. One should train himself in a manner of conduct as to offer the least possible exposure to danger of the eyes—never get the head into risky positions, never look back in a game (as handball) when the ball is likely to come up unexpectedly, form the habit of throwing the forearms up beside the face whenever possible as this will ward off many a chance blow, and any similar action, according to the circumstances of the game, that will aid in this direction. Finally, if ordinary lenses are used, one should have a set in a special, heavy-rimmed, strong frame that will resist breakage, just to be worn during the game—never, never play in rimless spectacles.

See also *care of the eyes* and *injuries to the eye.*

SPOTS BEFORE THE EYES. To see specks floating before the eyes, a condition known technically as *muscæ volitantes* or "flitting flies," is a not uncommon disorder and, in the majority of cases, is of no particular seriousness. It may follow spells of sick-headache or migraine, and is the result of nervous disturbances and not of any trouble in the eye structures. Most commonly the spots appear as a thin film or little chains of semi-transparent dots or circles, oftenest seen on looking toward a cloud or white wall, and sometimes discernible with the eyes closed as well as open. They may be experienced by any one and are of no special importance, being due simply to minute particles floating in the fluid that bathes the surface of the eye. Or they may be caused by a hemorrhage within the eyeball (from a blow, physical strain, etc.) which casts a

shadow on the retina; these will usually disappear in time as the hemorrhage is absorbed, but it is wisest to consult an oculist about them, just to be safe. Colored glasses may lessen the bother of floating spots.

But when the spots do not float about and are seen over a period of time always in the same place, they are likely to indicate something more serious—perhaps scars or opaque patches on the cornea, adhesions of the iris to the front of the crystalline lens (an aftermath of an iritis), opacities within the lens of the eye, which usually signify beginning cataract, etc. A person noting them should visit an oculist for examination and any necessary treatment.

Spots before the eyes are not to be confused with blind spots, or scotomata, within the eye (see *scotoma).*

SQUINT. *Cross-eyes* or *wall-eyes,* which see.

STRABISMUS. *Cross-eyes* or *wall-eyes,* which see.

STRAINING THE EYES. See *eye strain.*

STRENGTH OF GLASSES. This depends upon the optical power of the lenses which in turn is a result of the nature of the material, usually glass, of which the lens is made and the degree of curvature of both its surfaces, which governs its focal length. A lens is commonly considered "stronger" in proportion as its focal length is shorter, which means also in proportion as a lens is thicker and its surfaces more curved. See *lenses, focus,* and *diopter.*

STY. A small abscess (known technically as a *hordeolum)* at the edge of the eyelid resulting from the infection and inflammation of one (or more) of the tiny sebaceous or fat-producing glands in that part of the lid. Pus accumulates, and there is swelling and pain, but in itself a sty is ordinarily of no great consequence. Styes are especially likely to occur in children and young adults. Sometimes they recur or come in series or "crops," in which event a low state of general health, eye strain, or an uncorrected refractive defect of the eyes may be suspected as the predisposing cause. Rubbing the eyes to

relieve the itching of strain or an inflammation often introduces the infection to produce the sty.

Treatment is simply a matter of opening the abscess to drain it and applying mild medication to halt the infection; this should be done by a physician *only*. If the styes recur, it is particularly necessary to see a doctor as there is probably some basic condition that needs treatment. The only permissible home treatment is to put on the eyes gauze pads soaked in hot boric acid solution, which may induce the sty to open and discharge spontaneously; if it does not, any further attention must be from a doctor.

SUN BLINDNESS. Sight impairment resulting from direct exposure to extremely intense light, in particular from staring at the sun without protection for the eyes. Many cases of this follow a solar eclipse when persons look directly at the sun without the precaution of doing so through smoked glass or a piece of exposed photo film. The excessive light brings about changes in the retina that may be more or less permanent according to the degree of exposure. Since the light is focused at the central portion of the retina, the macula, it is this part that is most commonly affected; the result is a partial to complete blind spot, or scotoma, in the center of the visual field, the size and degree of blindness of the spot depending upon the extent of the damage done the retina. In severe cases this central blindness may be permanent, but usually there will be some recovery of sight. The eye should be rested and dark glasses worn, and of course it should be put under the care of an oculist. But the best cure, here as elsewhere, is prevention, which is simply a matter of wearing proper sunglasses when extremely bright light is likely to be encountered.

SUNGLASSES. The wearing of sunglasses has come to be something of a fad and affectation, possibly because they have been "glamorized" by being so widely worn by movie stars, in the attempt to achieve a conspicuous incognito. As a result their use has been overdone by the more impressionable portion of the public, and much evil has been done to eyes by the large sales of cheap and imperfect sunglasses.

Sunglasses should never be worn except when actually

necessary. Normal eyes are designed to stand a certain amount of light without harm, and to pamper any healthy organ in its normal function is to encourage that organ to weaken in its function; overuse of sunglasses may end by making the eyes dependent on them for even ordinary illumination intensities. The chief purpose of sunglasses is to shut out excessive light and glare, and to keep harmful rays from the eyes. The only harmful rays likely to be encountered by the average person are the infrared and the ultraviolet (which see), and in the amounts these are met with by the average person in routine living they will rarely prove harmful; it is only workers in special professions that as a rule require this protection. Excessive light is rarely met with in ordinary life if one is careful not to look directly into the sun, at an electric arc, into a powerful searchlight, etc. This leaves to sunglasses the prime function of cutting out glare. Prolonged exposure to glare can be harmful and fatiguing to the eyes (see *glare*), and protection against it is desirable. But actual tests by the Bureau of Standards have shown that many of the cheaper sunglasses keep out no more sun glare than does ordinary window glass. Other tests have shown that a great number of the cheap sunglasses (and the majority of the 20 million pairs sold yearly in this country retail for less than one dollar, a price for which a good pair simply cannot be made) are so imperfect optically that they will produce distortion of vision while being worn as great as the ordinary visual defect for which glasses are prescribed; some were found that had a minus error in one lens and a positive error in the other. Wearing such glasses may produce eye strain and headache, and do far more harm than good. Therefore, never buy cheap sunglasses (and certainly *never* the ten-cent store variety), but only those with lenses that have been *ground* (not blown or molded, as these frequently contain waves, bubbles, scratches, etc.) so as to be optically correct and permit undistorted vision. Buy only those with curved lenses, never with flat ones because these, even if ground, will give aberration and distortion when looked through obliquely. Be certain that the lenses are of a material and tint as actually to filter out glare and, if desired, infrared and ultraviolet rays. Blue is apparently the worst color that can

be chosen. Bright yellow lenses tend to sharpen vision (by eliminating obscuring blue haze), but are likely to bring on headache after prolonged wearing. The best of all tints seems to be soft green; the Army and Navy have chosen this after exhaustive tests. If one is exposed to certain rays from which he desires protection, lenses of special composition may now be obtained that will filter out rays of practically any specified wave-length; the Zeiss Optical Co. has done much work in this direction. If reflected glare is one's chief trouble, Polaroid glasses (which see) will take care of matters very well without coloring vision. Special Polaroid glasses are also obtainable having double lenses that can be adjusted to shut out any degree of light desired, even up to complete blackout. An interesting sunglass has lately been put on the market consisting of a frame into which lenses of different colors and densities (an assortment of which is supplied) may be snapped and varied at will; however, if all these lenses were correctly ground the price of the outfit would have to be quite high, whereas for average needs one correct lens will suffice. If a person wearing glasses for a refractive defect has much need for sunglasses, he had best get a special pair ground to his prescription in tinted lenses. If his need is only occasional, he can get a clip-on pair, with no optical power of course, which he may fasten on his regular spectacles when necessary. Persons wearing contact lenses can get these of tinted or filter glass also.

Since there are so many factors connected with choosing correct sunglasses, it is best to purchase them only from reputable opticians, never from department or ten-cent stores or from peddlers.

See also *goggles, glasses,* and *care of the eyes.*

SUNLIGHT. The direct light of the sun offers much too bright illumination for any close eye work—reading, writing, sewing, etc.—and should never be used for this purpose. The only manner in which it may be utilized is by diffusing it (as with translucent glass or other material) or by shading it from the work (as with an umbrella, blind, or the like). Under no circumstance is the sun to be looked into with the naked eye as this may result in permanent harm to the eyes (see *sun*

blindness). Nor is it advisable to try to do eye work in bright sunlight while wearing sunglasses, for the intensity of light reaching the eyes is still greater than is usually realized. On the whole, the use of sunlight and daylight is subject to all the rules and precautions of good illumination (see *lighting).*

SURGERY of the eye. See *operations.*

SWAYING. Same as *swinging,* which see.

SWINGING. One of the exercises commonly incorporated in the "sight without glasses" systems for correcting eye trouble by "natural" means. Stripped of all its rigmarole, it is simply a matter of standing with the feet several inches apart and rocking back and forth sideways while regarding the "apparent motion" of some object across the room, then closing the eyes while trying to visualize this same apparent motion and continuing the rocking, etc. This is supposed to have some profound effect not only on sight but on physical and mental health as well. Each quack has his own variations for the proper manner of performing this; some add the "long swing" which is essentially the same maneuver only rocking farther and twisting the body.

See *"Sight Without Glasses," quackery and fraud,* and *exercise.*

SYMPTOMS OF DEFECTIVE SIGHT. The earlier corrective measures are taken for defective sight, the sooner does one again enjoy adequate vision and general well-being, and the less likely it is that the eye trouble will grow worse until it may become more difficult, or even impossible, to help it. Since impaired vision is one of the first indictions of many grave eye disorders, its early recognition and treatment become doubly significant (see *diseases of the eye).* Failing general health and certain bodily illnesses also are often first reflected in the eyes (see *disease and sight).* Thus on several grounds it is important that deficient eyesight be recognized as early as possible in order that remedial steps may be taken when they will do the most good. Unfortunately, persons often go on for some time with moderately bad sight, usually not even aware that it is below normal.

One of the most obvious symptoms of failing sight is blurred, indistinct, dimmed, or otherwise unsatisfactory vision. When matters reach this stage most persons no longer hesitate to seek attention. But there are other warnings not directly affecting vision that may be noted sooner. One of the commonest of these is persistent headache, especially when there is no other ascertainable cause of the pain (see *headache).* Pain in the eyes, too, is an early indication of eye trouble, as is frequently recurring inflammation and soreness of the eyes, or of the eyelids, and burning, itching, and watering of the eyes. Also, puffed-up, swollen, or droopy eyelids may be traced to refractive defects. But the symptoms need not all be connected with the eyes; dizziness, nausea, and a sense of general fatigue on using the eyes for close work, may all be disorders that need only glasses or other eye treatment for correction. Sometimes there may be no noticeable pain or physical discomfort: in this event there will generally be a persistent tendency to scowl or "screw up" the eyes when attempting to see fine detail clearly, or even at all times; a need to hold one's book or paper closer or farther away than the normal distance from the eyes (14-18 inches) in order to read; the inability to sit anywhere in a movie with tolerable eye comfort (though of course one should never sit too close—see *movies);* and any other necessity of making special concessions to the eye which formerly were not needed to enjoy good sight. A frequent reddened or bloodshot condition of the eyes or series of recurring styes are usually indicative of an eye strain which may be relieved by glasses. Once any of these symptoms are consistently noted, the wise person will go immediately to a physician or oculist for a thorough examination to determine what his eye trouble is, if any, and to get the remedy it requires at once (see *examining the eyes).*

Children, who most of all need prompt correction of eye defects, are scarcely able to detect such trouble by themselves; it is consequently the duty of parents to be on the lookout for symptoms that point in this direction and to see that suitable care is given when any are noted (see *children's eyes).* Signs of bad eyesight in children are: frowning for no apparent reason; twitching of the face; excessive blinking and rubbing of the eyes; holding a book or pictures too close or too far

away, or squinting the eyes when looking at them; bending too far over toys or handwork, as drawing, etc.; a general tenseness of the body when using the eyes, especially when accompanied frequently by a gesture as if brushing a fly away from before the eyes; tilting the head to one side when looking at something; irritability and frequent complaint of headache; dislike of bright light; difficulty in catching or batting balls with reasonable accuracy; general clumsiness and a tendency to bump into things; a lack of interest in things at a distance; a tendency to weary quickly at anything calling for use of the eyes; dislike of reading; backwardness in school; and any other indications of reluctance or inefficiency in matters involving the eyes. If examination shows the sight to be normal, then the physician must seek further for the cause of these symptoms, but the eyes are one of the first things to be considered when any of them appear.

See also *defective sight, remedy of defective sight,* and *care of the eyes.*

SYPHILIS and sight. This terrible and common disease will sooner or later affect practically every organ in the body, and the eyes are no exception nor are they the last to feel its effects. No one is ever wholly safe from it since it may attack at any time of life, even months before birth, and from a great variety of sources.

Syphilis may attack the eyes in three general ways: by heredity, in which the unborn child gets the disease from its mother while it is still in the womb; by general infection in any of a number of manners; or by the introduction of the germs directly into the eyes. In the first case, suitable treatment of the mother, even up to the third or fourth month of pregnancy, will insure the child's being born free of the disorder. For the second and third, prevention is best: the avoidance of all possible sources of infection; consistent use of prophylactics in doubtful instances; extreme cleanliness; avoiding contact with public toilets; never using another's towel, comb, toothbrush, clothing, or any article that may carry infection; care in not rubbing the eyes with dirty or contaminated fingers; and hygienic conduct generally. If infection does take place, the *earlier* the treatment the better the

chance of recovery and saving the eyes. If allowed to go unchecked, the germs will finally attack and alter the structures of the eye or atrophy the optic nerve and end in blindness, paralyze the eye muscles and cause double vision, or affect the eyes in other ways.

See also *gonorrhea* and *diseases of the eye.*

TEAR GAS in the eyes. Tear gas is being used with sufficient frequency by police and riot squads to quell strikers, criminals, and mass disturbances of various sorts to render it likely that the average person may encounter it. Since it has marked effects on the eyes, it is therefore wise to be acquainted with emergency treatment in case of exposure to these fumes. Naturally, a physician should be gone to or sent for as soon as possible to render complete treatment, but in the meantime the following alleviating measures should be taken:

Get out of range of the gas immediately.

Do *not* rub the eyes.

Get to the nearest tap water (or other source of clean, clear water) and bathe the eyes and skin about the eyes repeatedly and copiously with water, using an eye cup or eye dropper if obtainable, soaking a clean cloth in water and squeezing it over the eye, or holding the eyes under a gentle stream of water if nothing else offers. If available, several successive administrations of a few drops of a solution of 0.4% sodium sulphite dissolved in 75% glycerin and 25% water will be soothing and helpful; if not available, continue the bathing with water. Any one likely to encounter tear gas should have a bottle of this solution on hand. Its use, however, does not dispense with the physician's services; he should be called or reached at the first possible moment, *without fail.*

The gas may also burn the skin about the eyes, and elsewhere, and for this a solution of 4% sodium sulphite in 50% alcohol will generally prove of benefit; but this solution must very carefully be kept separate and *must not* be used for or got into the eyes.

See also *acid* and *alkali.*

TEARING OF THE EYES. See *watering of the eyes.*

TEARS. These are the saline secretion or fluid produced by the lachrymal glands (which see) of the eyes. They flow in a slow stream from the glands, which are above and toward the

outer corner of each eye, to reach the eye beneath the upper lid at the upper, outer corner of the eye, and then spread and flow over the whole outer surface of the eyeball; they collect finally in the pocket formed between the lower eyelid and the eyeball, whence they are slowly drained away through two tiny openings, near the inner corner of the eye, into a little tube that empties into the nose. Normally this tube takes care of any excess of tears, but when the flow is greatly increased (as by irritation of the eye, emotion, etc.) the extra amount draining into the nose causes "snuffling"; and if the amount of tears gets too great for the tube to handle, the excess flows over and runs down the cheeks in the form commonly known as "tears."

The purpose of tears is to lubricate the surfaces between the lids and eyeball; to keep the surface of the eyeball moist and pliant; and to flush away dust and small particles that get into the eye, which accumulate in a little lump at the inner corner of the eye. In addition, tears contain a natural antiseptic substance (lysozyme) which is capable of destroying most of the ordinary bacteria that get into the eye, and thus prevent a great deal of eye infection.

TELESCOPIC LENSES. Special lenses for persons of such an advanced degree of sight impairment as to amount almost to partial blindness. They consist of two lenses of the usual kind, properly ground and mounted in a frame with one a short distance in front of the other; in effect they form a sort of telescope or, more properly, the whole set of glasses makes a kind of binoculars. Lenses of this type have succeeded in bringing serviceable vision to persons with sight so bad as scarcely to be able to get around without them. They also give the wearer much truer perspective than could be had with single lenses of such great thickness as to approximate the same optical power.

See also *lenses* and *glasses*.

TESTING THE EYES. A complete examination of the eyes has two major purposes: to look for any symptoms of disease, of the eye or of the system as a whole, so that early treatment may be started; and to determine the nature and degree of the optical or refractive defects of the eyes in order that suitable

glasses to correct them and restore good vision may be fitted. Both elements are important and no examination is truly complete if one is omitted, which makes it advisable that an oculist be consulted rather than an optometrist since only he can perform the examination with thoroughness (see *examining the eyes, optometrist, diseases of the eye,* and *disease and sight).*

Testing the optical or "seeing" power of the eyes may be done in two general ways: by subjective tests or by objective tests. In the former, the responses and reactions of the patient himself, as conveyed to the doctor, determine the result; in the latter, the doctor by means of instruments measures the characteristics of the patient's eyes (usually relaxed and dilated by "drops," which see), and determines the kind and amount of their impairment without any other reference to the patient or his reactions as noted by himself. This second method is usually employed with children, and sometimes with illiterates, who are unable to give information on the subjective tests. Most examiners combine the two methods to some extent.

The commonest and simplest subjective test is that with the Snellen test card (see *Snellen Chart).* This is hung up 20 feet from the patient in good illumination, and he reads down it as far as he is able with each eye separately (the other being covered) until he reaches print too fine to be discerned; this gives a measure of his visual acuity and amount of defect (see under *normal sight* for further discussion). Other charts of various combinations of diagonal lines of the same intensity are put up; and by noting which lines, if any, seem darker than the others to the patient, the presence and approximate direction of any astigmatism may be determined. The examiner then places on the patient an adjustable frame into which may be placed lenses and combinations of lenses of various sorts and powers until each eye is able to read the Snellen test card to as nearly the normal extent as can be achieved. The combined power of the test lenses used over each eye to manage it then gives the power of the lenses that must be ground for the patient's glasses. This, in substance, is still probably the most widely used method of fitting glasses.

Among the objective tests, the "shadow test" finds consider-

able employment, especially among children (see *shadow test).* The ophthalmoscope (which see), which is indispensable for examining the retina for signs of disorder, can also be used to test the refractive power of the eye by fitting it with a number of lenses of various powers in a revolving head so that any one of them can be placed at will before the aperture in the mirror. The beam of light is reflected into the eye in the usual manner, and if the patient's eye is normal the retina will be clearly discernible; if not, the retina will appear blurred (always assuming of course that the examiner's eye is normal or corrected to normal), and then by rotating the head of lenses one is found that enables the retina to be clearly seen (with the eyes of both patient and examiner relaxed for a true reading); this lens then indicates the power of the lens required to correct the vision of that eye. The same is repeated for the other eye, as both eyes are rarely if ever equally defective. For an accurate measure of astigmatism the ophthalmometer is generally utilized. This is a large precision instrument before which the patient places his head on a chin rest while images from odd-shaped illuminated apertures are reflected from the eye from various positions; any distortion in the cornea or lens produces a corresponding distortion in these images, the degree and direction of which distortion is measured by an observing, calibrated telescope through which the examiner looks at the eye; the power and direction of the necessary corrective cylindrical lens is thus found.

These by no means represent all the resources available to ophthalmology for measuring the power and defects of the eye, but they serve to indicate the nature of the methods most commonly employed.

See also *glasses* and *buying glasses.*

Tillyer Lenses. A special lens, developed by Dr. E. D. Tillyer, which overcomes one of the big disadvantages of ordinary lenses. In ordinary lenses there is a variation in optical power between the center and edge, and true correction is given only through the center. Tillyer lenses, on the other hand, are so made as to have the prescribed power throughout, and enable the eyes to look through any part of them with the same results. See also *lenses.*

TINTED GLASSES. See *sunglasses, lenses,* and *glasses.*

TIRED EYES. See *eye fatigue* and *eye strain.*

TOBACCO and sight. The excessive use of tobacco, particularly when combined with the abuse of alcohol, may sometimes bring about impairment and dimness of vision which cannot be rectified by glasses. There is a belief that the smoke getting into the eyes plays a part in this, but it is more likely some form of systemic poisoning because "tobacco blindness" is also found among tobacco chewers and in factory workers exposed to inhaling fine tobacco dust. Deficiency of vitamin B in the diet seems to predispose to this condition. As a rule, one of the first symptoms is an inability to distinguish small red or green objects, especially when in the center of the visual field, which makes this a potentially dangerous disorder for railroad men, motorists, etc. There is also generally a notable failure of sight, both eyes being commonly affected. Some persons are much more susceptible than others. The outlook for recovery is very good, usually calling only for *complete* discontinuance of tobacco (and also of alcohol if that is being used) until sight is restored, after which tobacco may be resumed in reasonable amounts. Persons past middle age usually take longer to recover than younger people.

See also *drink* and *drugs.*

TORIC LENSES. Lenses so ground as to bulge outward from the eye. This has several advantages over the ordinary flat lens: it permits a wider field of vision; it gives clearer and more nearly correct vision near the edge; and it permits the lens to be fitted closer to the eye without being brushed and smeared by the lashes. See also *lenses.*

TRACHOMA. One of the very serious eye diseases. It is a chronic, contagious inflammation of the conjunctiva in which the portion lining the upper eyelid becomes thickened and forms lumps of granulation which, if unchecked, may produce scars that permanently distort the eyelid. If these granulations are allowed to persist, their friction against the eye is likely to cause changes in the cornea with a loss of its transparency

and a consequent partial or complete blindness. It is very contagious, especially under poor and unsanitary living conditions, and may be passed from person to person in congested districts with surprising rapidity. This constitutes another reason against ever using another's towel, washrag, or any personal article, or rubbing the eyes with a dirty finger. It is essentially a disease of poverty and unhygienic living conditions. It is most common among the poorer and more crowded countries of Europe; it is estimated that 90% of Egyptians are infected with it. It was brought to this country by immigrants. Here it is most prevalent among the Indians and in the mountain regions of Kentucky, Virginia, West Virginia, and Tennessee; there are about 25,000 cases among the Indians and about 35,000 among non-Indians. Better living conditions and proper feeding are bringing it under control in the United States, but there is much to be desired.

Treatment of this disease is largely a matter of reducing the inflammation and removing the granules from the inside of the eyelids (by scraping or local caustic applications) before they can damage the eye. Naturally, this treatment is a matter for *only* an expert oculist or ophthalmic surgeon. There has been some encouraging success of late in treating trachoma with sulfanilamide, if the disease has not progressed too far, but this method is too new for definite knowledge.

See also *diseases of the eye* and *care of the eyes.*

TRANSPLANTING EYES. See under *operations.*

TRICHIASIS. A turning inward, toward the eye, of all or part of the eyelashes. There may be just a few misplaced lashes growing too far back on an otherwise normal eyelid; or practically the whole row of lashes may be directed backward as a result of a turning in of the edge of the lid from scarring following inflammation of the lid, as from a blepharitis or trachoma. Long continued bandaging of the eyes has been known to bring this about also. The constant rubbing of the inturned lashes against the eye may produce irritation and perhaps lead to ulceration of the cornea, with eventual opacity and loss of vision. The simplest and best remedy is to remove the lashes, either from time to time by plucking or

permanently by electrolysis, but this should be done by an oculist, *not* by a beauty operator.

TRIFOCAL LENSES. Lenses made according to the same idea as bifocal lenses (which see), only having areas ground for three different distances of vision instead of two. Usually the lower segment is for reading, the upper for street distances, and the center one for arm's-length or a little more distance (such as a painter or musician would work at) which is ordinarily served very poorly by bifocals. The real disadvantage of these lenses is that each segment area is so small that a tilt of the head must be carefully regulated.

See also *lenses.*

TUMOR OF THE EYELID. See *chalazion.*

TUNNEL EYES or VISION. A condition in which a person can see through only a very narrow range straight ahead and nothing to the sides, much as if looking through a tube or tunnel. Opacities of the margin of the cornea or lens, scotomata, or disorders of certain nerves of the eye may be responsible for it.

ULCER OF THE EYE. This may sometimes result from neglect of a sharp particle in the eye, especially if the particle was contaminated and introduced infection. Prompt, medical attention is necessary when particles persist in remaining in the eye, as such attention will usually prevent the ulceration, which all too often ends in blindness. This is borne out by the fact that more ulcers are found on the eyes of farmers than of factory workers, chiefly because quick medical treatment is generally accessible to the latter. Success has been obtained recently in treating these ulcers with sulfapyridine, but such treatment also must be early to be effective.

See also *foreign bodies in the eye.*

ULTRAVIOLET RAYS and sight. A certain amount of the exaggerated worry concerning the harmful effect on the eyes of ultraviolet rays, the invisible, short-wave rays of light, is in part responsible for the growing fad of wearing sunglasses when outdoors. No doubt the advertising of the manu-

facturers of sunglasses and special tinted lenses has much to do with the national consciousness of these rays. The average person needs no protection against the rays in the amounts they are encountered from the sun in ordinary, everyday life. True, in excess they can prove definitely damaging to the eyes, and any one thus exposed (as electric-arc welders, workers under mercury-vapor lamps, even persons spending the entire day in very bright sunlight) should unfailingly protect his eyes with lenses of proper color or of special composition that filters out the rays. But he should make certain that he is getting effective glasses, for many colored lenses on the market are of no more value than ordinary glass which filters out some rays (see *sunglasses*).

See also *infrared rays*.

VANITY AND GLASSES. See under *appearance and glasses*.

VENEREAL DISEASE and sight. See *gonorrhea* and *syphilis*.

VISION. See *sight*.

VISION, DEFECTIVE. See *defective sight*.

VISION, NORMAL. See *normal sight*.

VISION, REMEDY OF. See *remedy of defective vision*.

VISION, TESTING OF. See *testing the eyes*.

VISION RECOVERY. The time required by the eyes (mainly by the retina) to adjust themselves from bright illumination to dim before the temporary blinding effect (as from exposure to headlights when driving) passes and normal vision is regained for the lesser light. A deficiency of vitamin A seems to lengthen this period. A too long recovery period may be dangerous under certain circumstances, as in particular in driving a car against bright headlights at night (see *automobile driving*). For further discussion of the eyes' adjustment to light variations, see under *accommodation* and *retina*.

VISUAL ACUITY. The keenness or sharpness of a person's sight; the degree of his ability to discern fineness of detail at

a given distance or given details at varying distances. For a discussion of the limits of so-called "normal" visual acuity and the methods of measuring it, see *normal sight, Snellen chart,* and *testing the eyes.*

VISUAL PURPLE. A chemical substance (also called *rhodopsin)* found in the light-sensitive nerve endings of the retina (chiefly, if not solely, in the rods; there is some doubt as to whether or not there is any in the cones). By means of this substance it is believed that the physical stimuli of the incoming light rays are transformed into the physiological nerve impulses that are carried to the sight centers of the brain. This substance is purple in color when not acted on by light, but when exposed to light rays it bleaches or becomes whitened; this alteration probably involves a chemical process in which there is released energy which activates the retinal nerve cells. It is said that a change of only 8-9 molecules of it will give the sensation of sight. When the light is removed, this substance is regenerated by the eye, regains its purple color, and is again ready for use. Thus may be seen the eye's need for sufficient rest and sleep. Different wave-lengths of light carry out this bleaching at different rates of speed; those of the yellow part of the spectrum will do it about four times as rapidly as those of the red portion. Present indications are that adequate vitamin A in the diet promotes the regeneration of visual purple.

See also *sight* and *retina.*

VITAMINS and sight. These food elements, while in themselves offering no actual nourishment, are more and more being found vital for the preservation of general health (a good state of which is required to keep the eyes at their best—see *disease and sight).* Certain vitamins have been found to be indispensable in maintaining the tone of and activating the function of practically every organ of the body; if deficiencies occur in any of these, there will be corresponding disorder in the state and function of the organs requiring them.

The health of the eye and the excellence of vision are dependent upon an adequate supply of several of the vitamins

in the diet. However, by far the most important one appears to be vitamin A—so much so that it has sometimes been called the "eye vitamin." One of the most noteworthy consequences of a deficiency in this vitamin, even for only a few days, is night blindness (which see). But it has other effects too: it aids in shortening the period of vision recovery (which see), and promotes the regeneration of the visual purple (which see) of the eye. It seems also to help relieve some cases of color blindness. If its deficiency is long continued, a condition known as *xerophthalmia* (which see) may set in. Consequently, care should be taken to insure plenty of foods in the diet that are rich in vitamin A. Such foods are: butter, whole milk, egg yolks, carrots, tomatoes, lettuce, cabbage (especially the green leaves), celery, yellow corn, sweet potatoes, cantaloupe, pineapple, oysters, and cod-liver and halibut-liver oils.

A deficiency of vitamin B (which is a complex of several vitamins or variations of them) will often predispose one to alcohol or tobacco blindness. Vitamin B (or more particularly B_1 or F) is necessary for keeping the nerves of the body in good condition and its serious lack may well affect the nerves of the eye and bring on impairment of vision. It is believed by some authorities that vitamin B_2 (or G) may aid in the nourishment of the lens of the eye, and that its deficiency may encourage the formation of cataract. There have also been indications that insufficiency of B_2 may facilitate the eye's becoming bloodshot. Foods rich in vitamin B are: egg yolk, whole milk, asparagus, spinach, tomatoes, liver, kidney, brewer's yeast, and *whole* cereals.

Vitamin C, it is asserted by some, helps protect the eye against hemorrhage and infection. It is also thought necessary for the proper nourishment of the crystalline lens and its deficiency might therefore tend to bring on cataract. This vitamin is to be found in large amounts in: tomatoes, citrus fruits, cabbage, cauliflower, celery, spinach, watercress, and green peppers. Improper cooking destroys much of this vitamin.

A vitamin D deficiency (the vitamin so necessary for proper bone formation) may, besides producing rickets, at the same time encourage nearsightedness in young children. Plenty of

sunlight, irradiated milk, and regular dosage with cod-liver oil will safeguard this.

Most of the vision defects from inadequate vitamins are remedied when the proper amounts are again consumed, provided that the condition has not been allowed to persist too long. Re-adjustment of the diet is the best way of doing this, but it may be supplemented if necessary by vitamin pills or concentrates. However, these latter had best be prescribed by a physician.

See also *diet.*

VITREOUS HUMOR or BODY. A clear, jelly-like substance that fills the "posterior chamber," that portion behind the crystalline lens, of the eyeball. It completely occupies this space in the eyeball, and normally maintains just the correct tension to keep the eye of proper firmness and shape in its socket. Light rays are focused through it onto the retina by the lens.

See *eye* and *sight.* See also *aqueous humor.*

WALL-EYES. Divergent squint or strabismus, a condition in which one or both of the eyes point outward from their normal visual axes, or away from the nose. This disorder may in a sense be considered the opposite of cross-eyes, but fundamentally it is due to a similar state of muscular imbalance between the eyes, and like it gives rise to double vision. For further discussion of muscular imbalance and strabismus, see *cross-eyes.*

WASHES FOR THE EYES. See *eyewashes.*

WASHING THE EYES. There are many people who believe that the eyes are benefited by daily, routine flushing or washing, even when there is nothing wrong with them. The truth is that normal, healthy eyes need no washing; whatever is required in this direction is amply taken care of by the slow but constant flow of tear secretion. Indeed, since the tears contain a natural antiseptic (lysozyme), too much washing might prove harmful by carrying away this protection and leaving the eyes open to infection. About the only

occasions for flushing the average eye is when dust has got into it, or when it is reddened or itching and burning simply from over-use, or during a temporary and superficial irritation. Under these circumstances the washing should be done only with plain tap water, normal saline solution, or at most boric acid solution. Should the eyes require anything more than this, it must be only on the prescription of and as directed by a physician (see *eyewashes).*

See also *eye cup, care of the eyes,* and *patent medicines.*

WATERING OF THE EYES. A more or less constant overflow from the eye of the tear secretion and its running down the cheek may arise from a number of different causes. Any irritation or inflammation of the eye or the conjunctiva—foreign bodies in the eye, exposure to very bright light or to wind or smoke, colds in the nose, hay fever, infection, and other such disturbing conditions—will cause an excessive flow of tears too copious to be carried away to the nose by the little ducts at the inner corner of the eye (see *tears),* and it will consequently flood down the cheek. The removal or remedy of the cause of irritation will generally bring such watering under control. If the tiny openings of the tear ducts leading to the nose become blocked—either by swelling, constriction, or closure from some previous eye disease, or by mechanical blocking with an eyelash, or foreign particle—the tears, even when secreted in only normal amounts, will slowly overflow the cheek. The remedy is the opening of the tear ducts, which of course demands the services of a skilled oculist to administer whatever medication or surgery is necessary. If the watering is associated with a swelling at the inner corner of the eye by the nose, it usually means that the tear duct has become closed and the little lachrymal sac (in the duct leading to the nose) has become inflamed and swollen (a condition known as *dacryocystitis);* this should be given prompt and adequate treatment or it will end by becoming infected, forming pus, and growing worse. This disorder is found mostly in the very young and the very old, and demands expert attention. On the whole, it may be said that prolonged watering of the eyes, unless from a known temporary cause, should be a signal for an examination by a physician or oculist.

"WEAK" EYES or SIGHT. See *defective sight.*

WEARING GLASSES. In order to get the best results from glasses, they must of course be kept clean, free of scratches, in adjustment, and given proper care (see *care of glasses).* But they must also be worn correctly if satisfactory results are to be obtained. They must be kept in their proper position before the eyes, in the position to which they were adjusted by the oculist. One of the worst faults is allowing them to become tilted across the face so that one eye looks below the optical center of its lens and the other eye above it; this not only gives poor vision but produces eye strain. Nor should the glasses be permitted to slip down the nose; they should always be kept as close to the eyes as possible and should be so adjusted and worn. This not only gives better optical results by tending to confine vision to the center of the lenses, but it reduces the tendency to peer around the glasses, makes the rims and temples less noticeable to the wearer, and reduces the hazard of being knocked off. If the eyelashes are too long to permit close wearing (and lashes should never be allowed to brush the lenses, for this will keep the latter constantly smeared), it may be worth having them trimmed. Finally, they should be so worn that the plane of the lenses is at about right angles to the line of vision. Since most sight is directed downward a little, glasses are generally adjusted with the lenses tilting outward at the top just a trifle. If the glasses are permitted to tilt either way from this position to any appreciable extent, the result will be distorted vision. One should see that his frame is kept always in good condition and adjustment (for a bent frame cannot possibly be worn correctly), and to this end should visit his oculist regularly (preferably every six months) to have them checked, and immediately after any accident that might have affected their adjustment.

Properly fitted glasses should be comfortable to wear, after a reasonable period for growing accustomed to them; if they are not, it is usually an indication that they have not been correctly fitted, and the oculist should again be visited for a check-up. There are some sensitive individuals who are never able to become used to the pressure on the nose and ears; for

such persons nose supports and ear-hooks of special composition are available, or little soft pads and tubes to cover the regular ones, which help to relieve any irritation. Any well-equipped optician can supply such materials.

A person wearing glasses for the first time or a new pair is likely to have a little trouble in seeing at first: there may be a little dizziness or sick feeling, the floor or street may seem to slope away or come toward one as he walks, or there may be difficulty in judging distances or height of curbstones, etc. This may happen even in cases where glasses are perfectly ground and fitted, especially with stronger lenses with a big astigmatic correction. Most eyes require a little time to become used to new glasses, and after a few days these difficulties should disappear; if they do not, it is a sign that the glasses are not what they should be, and the oculist should be returned to for further examination and checking of the glasses. During this period of familiarizing oneself with glasses, it is not wise to drive a car, walk in congested traffic, or participate in circumstances that demand quick and accurate eye judgment.

See also *glasses* and *buying glasses*.

"WHITE" OF THE EYE. A common designation for the white, exposed portion of the sclera of the eyeball which surrounds the central area occupied by the cornea. See *sclera* and *eye*.

WORK AND SIGHT. See *industry and sight*.

WRITING. All close and detailed work, such as writing, throws an extra burden and strain on the eyes which can and should be minimized by a few simple precautions. These precautions have to do mainly with the illumination and conditions under which the writing is done. The light must be ample in amount and so arranged as to fall on the work without giving glare (especially reflected glare), shadows, or extreme contrasts. Details for correct lighting and avoidance of reflected glare are given elsewhere (see *lighting, lamps,* and *glare).* The elimination of shadows is merely a matter of so placing the light source in relation to the work that nothing comes between the two. Flowers, vases, and other forms on

the work table will often cast disturbing shadows; these should be removed. Shadow may be cast at just the worst spot by the writing hand; this may be avoided by having the light come somewhat from behind, from the left side if one is right-handed, and from the right side if one is left-handed. Contrasts in illumination may be cut down by having moderate, general lighting in the room. One should be comfortably seated so that the feet rest properly on the floor, and the back is about perpendicular to keep undue tension off the spine and back muscles; the table or desk should be of a height to permit the forearms to rest effortlessly upon it without exceptional bending over of the shoulders or stretching them upward from the pressure of the elbows on the table. The writing-paper should be 14-18 inches from the eyes. It should be of a dull finish to keep down glare. If the writer needs glasses, they should be worn and kept clean. And the eyes ought to be rested regularly by looking up (see *resting the eyes*).

See also *reading* and *care of the eyes.*

XEROPHTHALMIA. A rare eye disorder in which there is inflammation of the conjunctiva but without any discharge, the conjunctiva instead becoming dry, dull, and lusterless and taking on something of the appearance of ordinary skin. It is sometimes associated with certain forms of eye paralysis. It is also considered a possible result of vitamin A deficiency.

X-RAYS and sight. In anything more than occasional nominal amounts, exposure to x-ray radiations is likely to affect adversely any tissue or organ of the body, and the eye with its complex and delicate structure is more susceptible than most. Excessive exposure to these rays may produce permanent alterations in the eye and, if continued, lead to blindness. Fortunately, the average person rarely comes in contact with x-rays for a period of time long enough to prove harmful. But persons whose work brings them frequently in the presence of these radiations (diagnosticians and their assistants, x-ray technicians, research workers, etc.) must take special precautions to protect their eyes, as indeed they must for the rest of their body also. There are now available lenses of

special composition that will filter out these rays while permitting vision, and they should be worn unfailingly by these workers whenever they are exposed to the rays. X-rays are very treacherous: they are invisible to ordinary sight, they will penetrate considerable thicknesses of most materials, and they will leak out in the most unexpected places. Constant vigilance is to be exercised with them.

See also *sunglasses, infrared rays,* and *ultraviolet rays.*

"YELLOW SPOT" of the retina. The *macula lutea,* which see.

M. Johnston
1068 Hi Point
L.A., 35